Verilink QUAD/IMUX User Manual

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FCC Requirements

This equipment has been tested and found to comply within the limits for a Class A digital device pursuant to Part 15 of the Federal Communications Commission (FCC) rules. These limits are designed to provide protection against harmful interference in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, can cause harmful interference to radio communications.

There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception—which can be determined by turning the equipment off and on—try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with Part 68 of the FCC Rules. On the rear, side or bottom of the unit is a label that contains the FCC registration number and other information. If requested, provide this information to the telephone company.

- All direct connections to the network lines must be made using standard plugs and jacks (compliant with Part 68). The following tables list the applicable registration jack universal order codes (USOCs), facility interface codes (FICs), and service order codes (SOCs). These are required to order service from the telco.

For T1 interfaces:

Port ID	REN / SOC	FIC	USOC
1.544 Mbit/s SF 1.544 Mbit/s SF, B8ZS 1.544 Mbit/s ANSI ESF 1.544 Mbit/s ANSI ESF, B8ZS	6.0N	04DU9 -BN 04DU9 -DN 04DU9 -1KN 04DU9 -1SN	RJ-48C jack

For DDS interfaces:

Port ID	REN / SOC	FIC	USOC
56 kbit/s 64 kbit/s	6.0N	04DU5 -56 04DU5 - 64	RJ-48S jack

- If the unit appears to be malfunctioning, inform the telco and disconnect it from the network lines until the source of trouble is determined to be your equipment or the telephone line . If your equipment needs repair, it should not be reconnected until it is repaired.
- The unit has been designed to prevent harm to the network. If the telephone company finds that the equipment is exceeding tolerable parameters, it can temporarily disconnect service. In this case, the telephone company will provide you advance notice if possible.

- If the telephone company alters its equipment in a manner that can affect the use of this device, it must give you warning so that you have the opportunity to maintain uninterrupted service. You will be advised of your right to file a complaint with the FCC.
- No customer is authorized to repair this equipment, regardless of warranty status. All repairs must be performed by Verilink or an authorized agent. It is the responsibility of users requiring service to report the need for service to Verilink or to one of our authorized agents.

Lithium Battery

The lithium battery referred to in the following notices is contained inside the clock chip.

English

DANGER!

The battery can explode if incorrectly replaced! Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

DANGER!

To avoid electrical shock in case of failure, the power supply must be installed by a professional installer. The terminal labeled with the ground symbol (⏚) on the power supply must be connected to a permanent earth ground.

CAUTION!

Interconnecting circuits must comply with the requirements of EN60950:1992/A4:1997 Section 6.2 for telecommunications network voltages (TNV) circuits.

Français

ATTENTION!

Une explosion peut se produire si la batterie est remplacée d' une façon incorrecte! Remplacez-la seulement avec le même modèle de batterie ou un modèle équivalent selon les recommendations de manufacture. Disposez de les batteries usées selon les instructions de manufacture.

ATTENTION!

Pour éviter choc électrique en cas de insuccès, la provision de pouvoir doit êtré installé par un installeur professionnel. Le terminal de la provision de pouvoir, marqué du symbol de terre, (⏚) doit connecté à un circuit de terre permanent.

PRUDENT!

Les circuits doivent êtré interconnectés de manière à ce que l' équipement continue a êtré en agrément avec "EN60950:1992/A4:1997, Section 6.2, pour les circuits de voltage de liaisons d' échanges (réseau) par les télécommunications (TNV)," après les connections de circuits.

Española

ATTENCION!

La bateria puede explotar si se reemplaza incorrectamente. Reemplace la bateria con el mismo tipo de bateria ó una equivalente recomendada por el manufacturero. Disponga de las baterias de acuerdo con las instrucciones del manufacturero.

ATTENCION!

Para evitar contacto con circuitos que electrocutan, la fuente de alimentación debe ser instalada por un técnico profesional. La terminal de la fuente de alimentación marcada con el símbolo de tierra (⏚) debe ser conectada a un circuito de vuelta por tierra permanente.

PELIGRO!

Circuitos que se interconectan a la red de telecomunicaciones deben hacerse de tal manera que cumplan con los requisitos estipulados en las especificaciones "EN60950:1992/A4:1997, Sección 6.2, para los voltages de circuitos interconnectados a la Red de Telecomunicaciones (TNV)," despues de terminar las connecciones entre los circuitos.

Deutsch

VORSICHT!

Explosionsgefahr bei unsachgemäßem Ersetzen der Batterie! Batterie gleichen Typs und gleicher Qualität benutzen, wie vom Hersteller empfohlen. Entsorgung der Batterie nach Anweisung des Herstellers!

VORSICHT, GEFAHR!

Um keinen Schlag zu erhalten beim Versagen der electrischen Anlage, muss der Stromanschluss von einem Elektriker vorgenommen werden. Der elektrische Pol, versehen mit dem Erdsymbol (⏚) muss am Stromanschluss permanent geerdet sein.

VORSICHT!

Schaltungen, die in den Geräten zusammengeschaltet sind, müssen weiterhin den Vorschriften EN60950:1992/A4:1997, Absatz 6.2 für Telecommunications Netz Spannung (TNV) Schaltkreize entsprechen.

Canadian Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A) prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

The Industry Canada label indentifies CS-03 certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Safety Precautions

This equipment is intended to be installed only in a Restricted Access Location that meets the following criteria:

- Access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that must be taken.
- Access can only be gained through the use of a lock and key or other means of security, and is controlled by the authority responsible for the location.

When handling this equipment, follow these basic safety precautions to reduce the risk of electric shock and injury:

- Follow all warnings and instructions marked on the product and in the manual.
- Unplug the hardware from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a cloth slightly dampened with water.
- Do not place this product on an unstable cart, stand, or table. It may fall, causing serious damage to the product.
- Slots and openings in the shelves are provided for ventilation to protect them from overheating. These openings must not be blocked or covered. Never place this product near a radiator or heat register.

- This product should be operated only from the type of power source indicated on the marking label and manual. If you are unsure of the type of power supply you are using, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will interfere with the free movement of people.
- Do not overload wall outlets and extension cords, as this can result in fire or electric shock.
- Never push objects of any kind into the shelves. They may touch dangerous voltage points or short out parts that could result in fire or electric shock. Never spill liquid of any kind on this equipment.
- Unplug the equipment from the wall outlet and refer servicing to qualified service personnel under the following conditions:
    - When the power supply cord or plug is damaged or frayed.
    - If liquid has been spilled into the product.
    - If the product has been exposed to rain or water.
    - If the product has been dropped or if the cabinet has been damaged.

Product Warranty

Verilink's product warranty covers repair or replacement of all equipment under normal use for a five-year period from date of shipment. Replacement products may be new or reconditioned. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer. Our in-house Repair Center services returns within ten working days.

Customer Service

Verilink offers the following services:

- System Engineers at regional sales offices for network design and planning assistance (800) 837-4546
- Technical Assistance Center for free 24x7 telephone support during installation, maintenance, and troubleshooting (800) 285-2755 and support@verilink.com
- To return a product, it must be assigned a Return Materials Authorization (RMA) number before sending it to Verilink for repair (800) 926-0085, ext. 2282
- Maintenance contracts and leasing plans (800) 837-4546
- Technical Training on network concepts and Verilink products (800) 282-2755 and training@verilink.com
- Web site (www.verilink.com)

Publications Staff

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Chapter 1 Overview

This manual describes Verilink's Access System 2000 T1/E1 Inverse Multiplexer system (QUAD/IMUX). It is assumed that the reader is familiar with basic telecommunications and the AS2000 platform (see the manual *AS2000: The Basics* for information about the AS2000 platform).

Manual Organization

The contents of this manual are divided according to the following plan.

- This chapter contains an overview of the QUAD/IMUX product and includes features and specifications.
- Chapter 2, "*Quick Set-Up*", contains a Quick-Start Guide which gives a step-by-step installation procedure for a typical United States T1 installation.
- Chapter 3, "*E1 Configuration Menus*", contains detailed information on the E1 version of the QUAD/IMUX used in Europe and most of the world outside North America.
- Chapter 4, "*T1 Configuration Menus*", contains detailed information on the T1 version used in North America, the Philipine Islands and Japan.
- Chapter 5, "*Performance Monitoring*", details the performance monitoring features of the QUAD/IMUX.
- Chapter 6, "*Diagnostics*", explains the diagnostic features of the QUAD/IMUX.
- Appendix A, "*Default Configuration*", presents the factory default values for the QUAD 2164 and IMUX 2160 modules used in the QUAD/IMUX.

Other Manuals

General information on Verilink products, and information on other, related products is listed below.

- The manual *AS2000: The Basics* provides detailed information on AS2000 shelves, cables and physical installation procedures.
- The *NCM 2000 User Manual* provides information on the Node Controller Module which is often used to control a QUAD/IMUX installation.

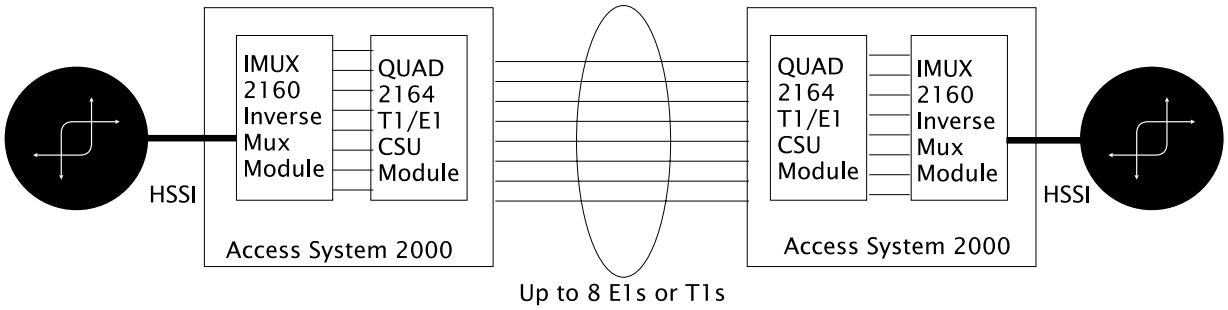
Features

Each Inverse Multiplexer system requires at least two different modules: the IMUX 2160 and the QUAD 2164. When more than 4 E1 or T1 circuits are supported, two of the QUAD 2164 modules are used.

System

The IMUX 2160 interfaces to data terminal equipment (DTE), and the QUAD 2164 accesses a T1 or E1 network. These modules form a single system for distributing data from a high-speed source over multiple T1s or E1s for a maximum of 12 Mbit/s over 8 T1s or 16 Mbit/s over 8 E1s.

Figure 1-1 High-Speed Router using Inverse Multiplexing



The IMUX 2160 rear connector module is available with a V.35, EIA 530, EIA 530A, RS-449 or HSSI data port. The V.35, EIA 530, EIA 530A and RS-449 interfaces support up to 4 T1s or 3 E1s for a data rate slightly over 6 Mbit/s, whereas the HSSI interface supports up to 8 T1s at a data rate of 12 Mbps or 8 E1s at a data rate of 16 Mbit/s.

The QUAD 2164 rear connector module determines whether a given QUAD 2164 module will handle E1 or T1 lines.

The Inverse Multiplexer system can operate with or without an NCM 2000 (Node Controller Module). Simple point-to-point applications can operate in standalone mode. With multiple applications at an AS2000 node, the Inverse multiplexer is managed using the NCM 2000.

The QUAD/IMUX provides the following features:

T1 Interfaces	The DS-1 (long-haul) and DSX-1 (short-haul) QUAD interfaces are fully compatible with industry-standard framing and line coding options (ESF, SF, AMI, B8ZS).
E1 Interfaces	The 75 ohm and 120 ohm E1 QUAD interfaces support HDB3 line coding.
Data Rates	The Inverse Multiplexer has selectable data rates: n*x*1.336 Mbit/s (in 56K mode), n*x*1.528 Mbit/s (in 64K T1 mode), or n*x*1.976 Mbit/s (E1 mode), where n=1 to 8.

Delay Equalization	To ensure proper alignment of your high-speed data, the Inverse Multiplexer has built-in mechanisms to provide sensitive delay equalization of the T1 or E1 network streams. (The delay is a maximum of 30 milliseconds between T1/E1 lines.)
Performance Monitoring	An overhead framing scheme provides critical error monitoring capabilities, and an inband channel for remote site communications.
Line Removal and Restoral	The DS-1 line is removed from service when the alarm thresholds are exceeded for BER, SES, UAS, or CRC.
Automatic Rate Adaption	For greater network protection, automatic rate adaption is included to adjust the data rate to lower speeds when the performance of individual T1 or E1 circuits degrade or fail. When the network circuits return to acceptable performance, the IMUX automatically restores the original data rate.
SNMP	The Inverse Multiplexer system includes an embedded SNMP agent that supports standard MIBs, and provides extensions to access product-specific parameters. Physical access is provided by a 10BaseT Ethernet connection located on the front panel of the QUAD 2164 card. When used with an NCM 2000 module, the NCM handles the 10BaseT Ethernet connection and the QUAD 2164 Ethernet port is shut off.

Module Details

This section provides detail on the features of the two Inverse Multiplexer modules, the QUAD 2164, and the IMUX 2160.

QUAD 2164 Module

The QUAD 2164 module provides:

- All CSU functionality for the network side. This includes performance monitoring, framing, timing recovery and/or generation, error checking, and loopbacks on the network side.
- Line removal and restoral upon exceeding specified alarm thresholds.
- Shelf controller, if required.

Each **QUAD 2164 module** provides four T1 or E1 network connections. The four associated connector interface modules (CIMs) provide integral T1 CSUs for long-haul connections, or DSX-1 interfaces for short-haul connection to an M1-3 multiplexer. All lines making up an aggregate line will have the same configuration values.

The QUAD 2164 module exchanges user data with the IMUX 2160 across Data Bus A on the shelf backplane.

IMUX 2160 Module

The IMUX 2160 module provides the high-speed serial interface to your data terminal equipment (DTE). The available connector interface modules (CIMs) include HSSI, V.35, RS-449, EIA 530, or EIA 530A interfaces.

In the transmit direction, the IMUX 2160 takes a high speed synchronous serial data stream and repackages the data into a unique, proprietary frame for transmission by the QUAD 2164 module(s). It recombines T1 or E1 data streams received from the network by managing the time delays and resequencing the individual network data streams.

The IMUX 2160 sets up the data rate and provides the autobaud function at the data port interface, automatically adapting when a network line drops. It handles data port loopbacks and alarms, providing error checking and frame detection for the proprietary IMUX 2160 frame format.

Although Verilink uses a proprietary inverse multiplexing technique on the T1 and E1 network side, the data port functionality supports industry standards for the synchronous serial interfaces.

Shelf Options

To set up a standalone application for two to four T1s or E1s, you can use the DLS 2100 (Dual-Line Shelf) with one QUAD 2164 module in slot 1 and one IMUX 2160 module.

If your Inverse Multiplexing application requires support for more than 4 E1 or T1 lines, use the MLS 2200, MLS 2200-4*i*, or the QLS 2500 (Quint-Line Shelf).

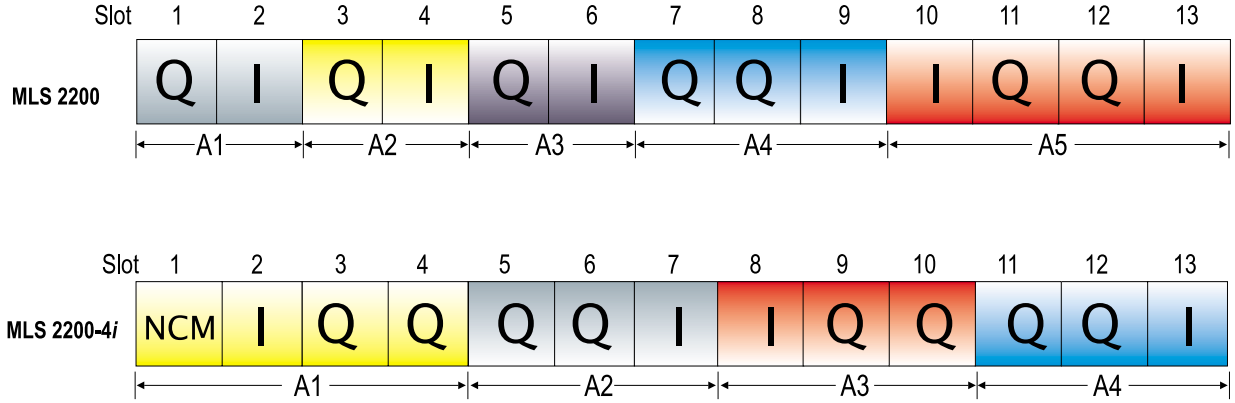
The Inverse Multiplexer modules use Data Bus A to transmit data between modules. Since the MLS 2200 shelves differ in how they segment bus A, exercise caution when placing the QUAD and IMUX 2160 modules within 2200 shelves. Two IMUX 2160 cards can reside on the same bus A if they are sharing the ports of one QUAD 2164.

The MLS 2000, QLS 2500, and DLS 2100 do not segment Bus A, therefore these shelves may not contain more than one QUAD/IMUX installation.

MLS 2200 Shelves

The MLS 2200 and MLS 2200-4*i* segment Data Bus A as shown in Figure 1-2.

Figure 1-2 Multiline shelf "A" Bus Segmentation



Module Placement

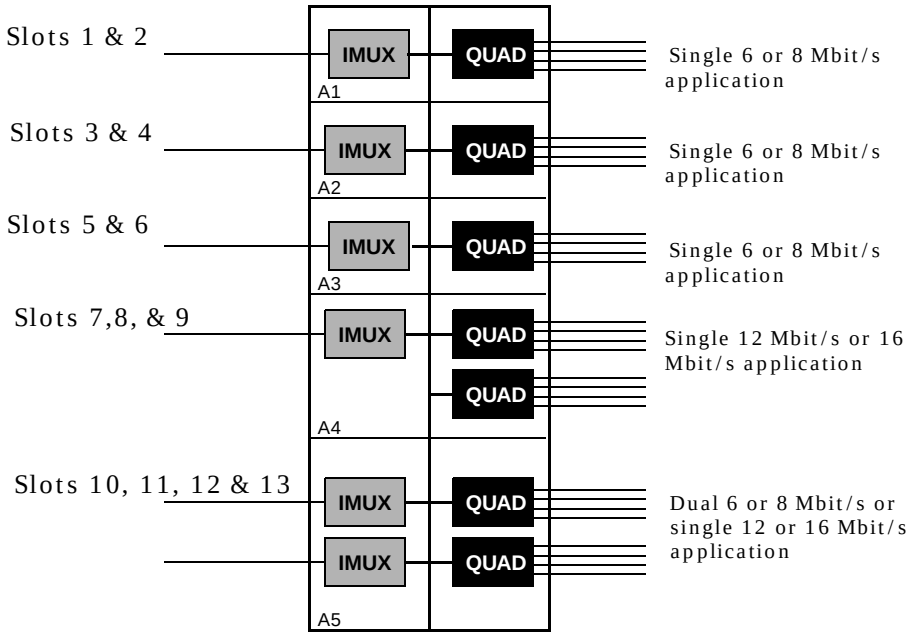
Each Inverse Multiplexer application must have sole use of Data Bus A, or a Bus A segment. The first QUAD 2164 module in any bus island (carrying the first four T1s or E1s) *must be installed in an odd-numbered slot*.

The second QUAD 2164 module in any bus island, carrying the second four T1s or E1s, must be installed in an even-numbered slot. The IMUX 2160 module may be placed in an odd or even numbered slot.

Maximized MLS 2200 Installation

Using the MLS 2200, you can install and configure up to six user applications. Figure 1-3 shows a shelf with a maximized installation using multiple configurations.

Figure 1-3 MLS 2200 Application Support



Inverse Multiplexer Configurations

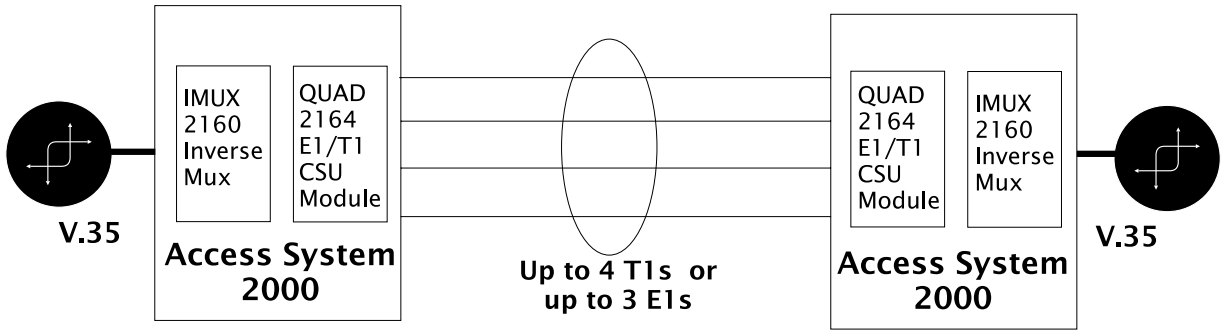
Each QUAD 2164 module can aggregate up to four T1 or E1s. Two QUAD 2164 modules can be paired with an IMUX 2160 module to provide a single router with 12 Mbit/s from T1 or 16 Mbit/s for E1. To distribute the bandwidth of four T1 or E1s across two routers, pair a single QUAD 2164 module with two IMUX 2160 modules (one for each router).

Inverse Multiplexer provides an essential link between high bandwidth applications and carrier services. Built as an alternative to DS3 services, Inverse Multiplexer provides the ability to meet the increased bandwidth required by applications such as high-speed LAN and high-resolution video conferencing.

One QUAD 2164, One IMUX 2160

Pairing a single QUAD 2164 module with an IMUX 2160 module fitted with a V.35 rear interface connector provides up to 6 Mbit/s (T1) or 8 Mbit/s (E1) of usable bandwidth.

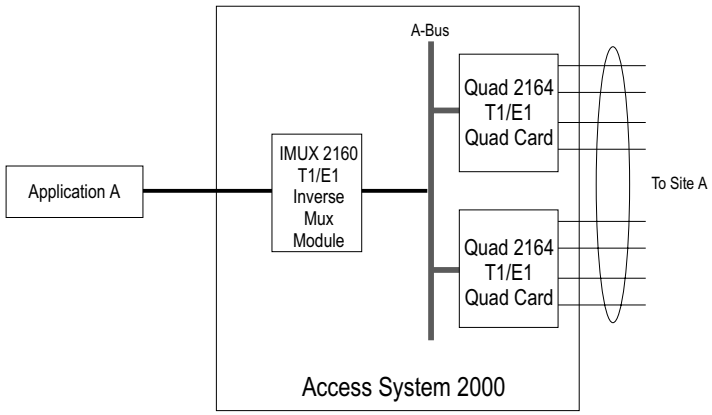
Figure 1-4 V.35 Interface with Single Application



Two QUAD 2164, One IMUX 2160

One IMUX 2160 module fitted with a HSSI rear interface module and two QUAD 2164 modules can achieve a T1 bandwidth of 12 Mbit/s, or an E1 bandwidth of 16 Mbit/s.

Figure 1-5 One 12 Mbit/s Application,



Specifications

Table 1-1 lists the specifications of the QUAD 2164 module.

Table 1-1 QUAD 2164 Module

	T1 Version	E1 Version
Number of Network Ports	4 per module	4 per module
Line Rate	1.544 Mbit/s ± 32 ppm	2.048 Mbit/s ± 32 ppm
Line Code	AMI, B8ZS	HDB3
Framing Format	SF or ESF	E1
Impedance	100 Ohms ± 5%	120 Ohms ± 5%, 75 Ohms ± 5%
Input Level	CIM 2064 and CIM 2068: 3.0 V ± 0.3 V base-to-peak, attenuated by 0 to 27.5 dB	CIM 29001LP — 75 Ohms CIM 29120LP — 120 Ohms
Output Level	3.0 V ± 0.3 V base-to-peak or DSX-1 into 100 Ohms at 0 dB LBO	N/A
Output LBO [CIM 2064]	0, 7.5, 15, or 22.5 dB (0 to 3000 feet), selectable	N/A
Equalization [CIM 2068]	1-133 ft., 133-266 ft., 266-399 ft., 399-533 ft., 533-655 ft.	
Loopbacks	Line, Payload, Repeater (local)	Line, Payload, Repeater (local)
Timing Modes	External, Network, and Internal	External, Network, and Internal
Technical and Regulatory Compliance	AT&T 54016, AT&T 62411, ANSI T1.403, FCC Part 68, UL 1459 Revision 2	ITU-T G.826, G.703, G.704, G.732
LED Indicators (Tricolor)	4 Network, 1 System	4 Network, 1 System
Management Ports	Front Panel 10BaseT Ethernet port for support of three subsets of TCP/IP: SNMP, Telnet and FTP (8-pin, RJ-45) Local Craft serial port (6-pin, RJ-11)	Front Panel 10BaseT Ethernet port for support of three subsets of TCP/IP: SNMP, Telnet and FTP (8-pin, RJ-45) Local Craft serial port (6-pin, RJ-11)

Table 1-2 Connector Interface Modules for the QUAD 2164

Connector Interface Modules for QUAD 2164			
Module	**Electrical Interface**	**Physical Interface**	**Bandwidth Capacity**
CIM 2064	T1 DS-1	RJ-45 (8-pin)	1.544 Mbit/s x 4
CIM 2068	T1 DSX-1	RJ-45 (8-pin)	1.544 Mbit/s x 4
CIM 29001LP	CEPT-1 75 Ohm	BNC (Coax)	2.048 Mbit/s x 4
CIM 29120LP	CEPT-1 120 Ohm	RJ-48C (8 pin)	2.048 Mbit/s x 4

Figure 1-6 QUAD 2164 Front Panel with CIM Rear Panels

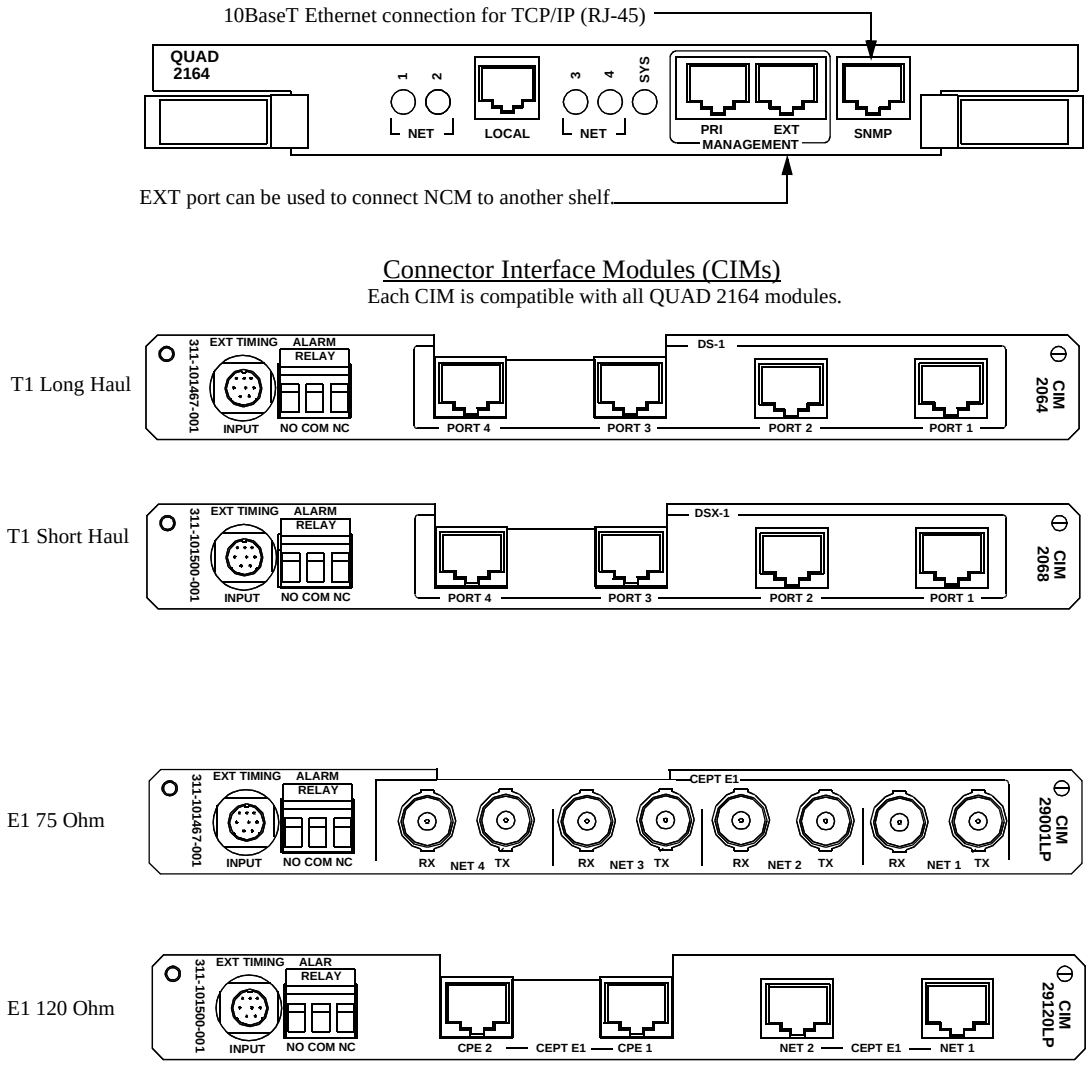


Table 1-3 IMUX 2160 module

Number of DTE Ports	1 per module
Data Rate (dependent on line coding)	T1: *n* x 1.336 Mbit/s, where *n* = 1 to 8 or *n* x 1.528 Mbit/s, where *n* =1 to 8 depending on AMI or B8ZS T1 types. E1: *n* x 1.976 Mbit/s, where *n* = 1 to 8
LED Indicators (Tricolor)	Data, Status, Net

Table 1-4 DTE Interface Modules for IMUX 2160

DTE Interface Modules for IMUX 2160			
Module	**Electrical Interface**	**Physical Interface**	**Bandwidth Capacity**
DIM 2660	HSSI	50-pin Amplimite	16 Mbit/s
DIM 2635	V.35	Winchester 34-pin	6 Mbit/s
DIM 2650	EIA 530A	DB-25	6 Mbit/s
DIM 2651	EIA 530	DB-25	6 Mbit/s
DIM 2652	RS-449	DB-37	6 Mbit/s

DTE Adapter Cables

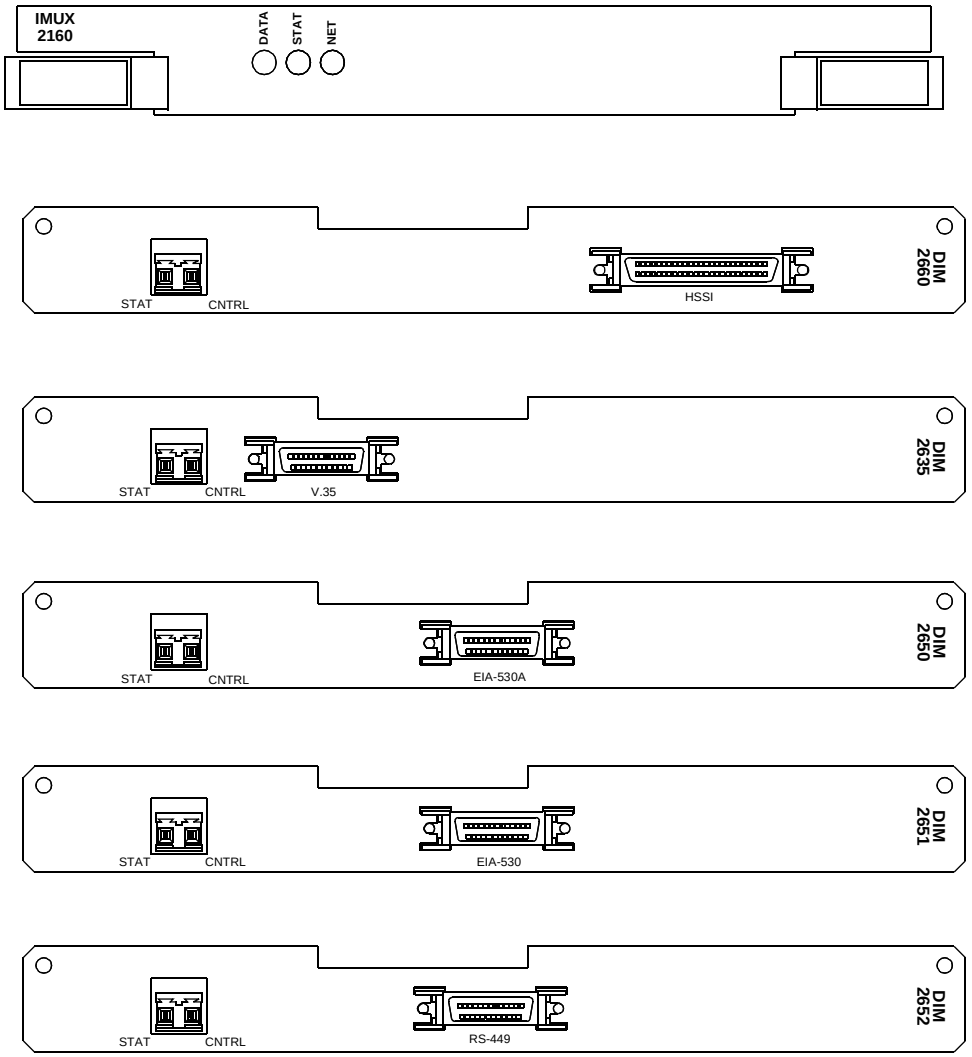
For the HSSI interface type, the connector present on the DIM 2660 rear connector module is the 50-pin mini D-sub connector described in the HSSI specification. Use a 50-pin mini D-sub male-to-male straight-through cable to connect the DTE, such as Verilink P/N 458-502204-015.

For interfaces other than HSSI, the rear connector module (DIM) has a 26-pin mini-D SUB connector. An adapter (pigtail) cable is provided which presents the typical connector type for the electrical interface. These cables are described in Table 1-5.

Table 1-5 IMUX 2160 DTE Interface Adapter Cables

Cable P/N	Electrical Interface	Connector Presented
458-501594-001	ITU V.35	Winchester 34-pin female
458-502059-001	RS-449 (RS-422)	DB-37 female
458-502045-001	EIA 530	DB-25 female

Figure 1-7 IMUX 2160 Front Panel with CIM Rear Panels



Chapter 2

Quick Set-Up

Quick Set-Up takes you through the steps necessary to configure a typical Inverse Multiplexer configuration. It is intended as an introduction to the process

Each of the E1 version menus are fully described in *E1 Configuration Menus*. Each of the T1 version menus are fully described in *T1 Configuration Menus*.

Example Network

The following assumptions are made for this example configuration:

- A central site location includes an MLS 2200 (13 slot shelf) with two QUAD/IMUX installations, one using four T1 circuits and the other using eight T1s.
- The central site is managed using an NCM 2000 module. The NCM 2000 is connected to an Ethernet LAN using the provided Ethernet 10BaseT/10Base2 transceiver. The first QUAD/IMUX installation at the central site uses a QUAD 2164 module in slot 3, and an IMUX 2160 module in slot 4. The second QUAD/IMUX installation at the central site uses QUAD 2164 modules in slots 7 and 8, and an IMUX 2160 in slot 9.
- The remote sites are both managed by TCP/IP Ethernet LAN connections to the QUAD 2164 module front panel 10BaseT port (may be labelled SNMP).
- The first remote QUAD/IMUX is housed in a Dual-line Shelf (DLS 2100) with a QUAD 2164 module in slot 1, and the IMUX 2160 in slot 2. This site connects to the 4 T1 QUAD/IMUX installation in slots 3 and 4 at the central site.
- The second remote QUAD/IMUX is housed in a Quint-line Shelf, with QUAD 2164 modules in slots 1 and 2, and the IMUX 2160 module in slot 3. This site connects to the 8 T1 QUAD/IMUX installation in slots 7, 8, and 9 at the central site.
- All of the T1 facilities used are handled by the same Inter-Exchange Carrier (long distance carrier) and the carrier provides timing by routing each T1 through a Digital Cross-connect System (DACS). This allows a common timing source to be used for both QUAD/IMUX installations—a required condition.

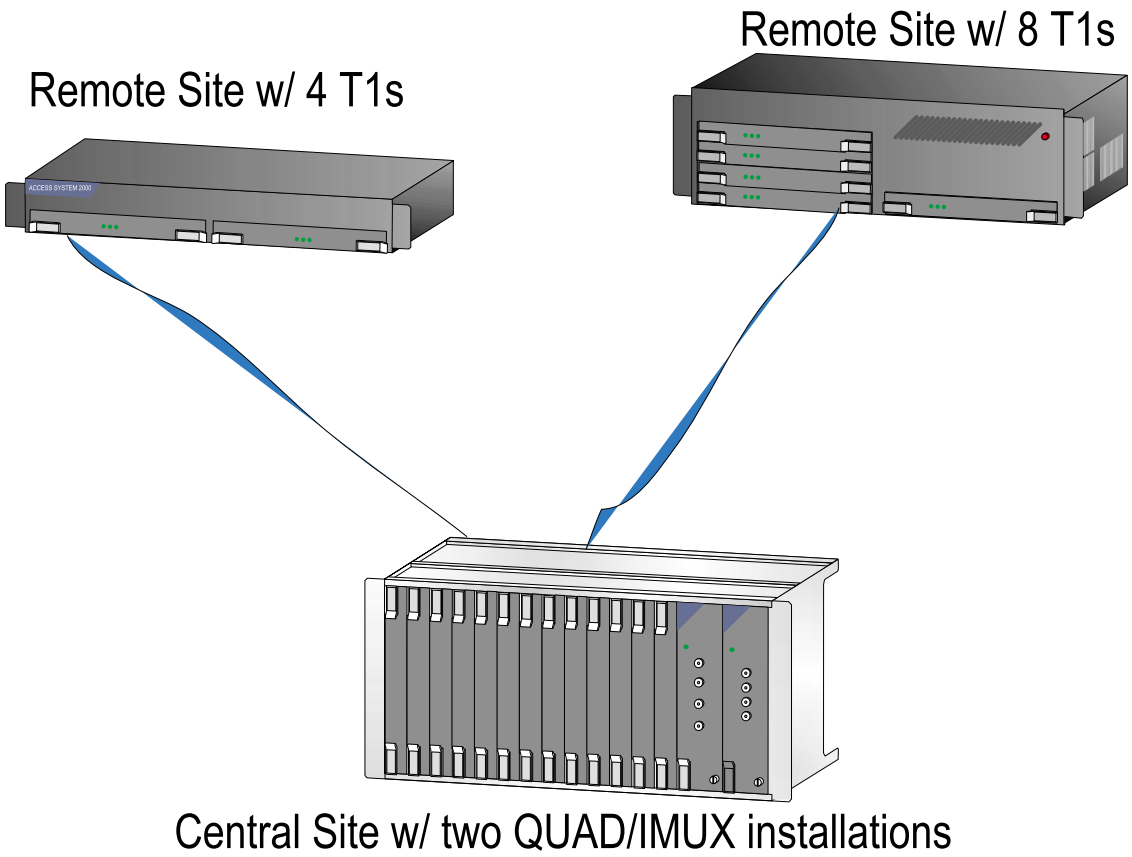
NOTE: *When more than one QUAD/IMUX is installed in the same shelf all QUAD/IMUX installations in that shelf must use the same timing source. Each QUAD/IMUX must have the* **Receive clock from shelf** *option set to* **Yes**. *Each shelf may have only one active timing source.*

- The IMUX 2160 in slot 4 uses 4 T1 circuits with a V.35 rear interface module (DIM 2635). The IMUX 2160 in slot 9 uses 8 T1 circuits with a HSSI rear interface module (DIM 2660).

NOTE: *Since the V.35, RS-449 and EIA 530 electrical interfaces only provide reliable operation at rates up to 6 Mbit/s, any QUAD/IMUX installation which uses more than 4 T1 circuits or more than 3 E1 circuits requires the use of a HSSI rear connector module (DIM 2660) for the IMUX 2160. HSSI is designed to provide reliable operation at up to 52 Mbit/s.*

- The DTE (Data Terminal Equipment) to be connected at each site consists of TCP/IP routers. At the central site two different WAN ports of the same router will be connected to the two QUAD/IMUX installations.
- All of the T1 circuits use ESF framing and B8ZS line coding.

Figure 2-1 Example Configuration



Connect a Terminal

The terminal used to configure the QUAD/IMUX may be any ASCII terminal or terminal emulator program. No specific terminal emulation mode is required. Use one of the two available Craft cables to connect the terminal or PC to the LOCAL port on the NCM 2000 front module.

Craft Cable

The current version Craft cable pinout is as follows:

Table 2-1 DB-9 Craft Cable P/N 458-102119-008

DB-9 female	6 wide modular (RJ-11 type)	Usage
pin 3	pin 3	Transmit Data
pin 2	pin 4	Receive Data
pin 5	pin 5	Signal Ground

An older version Craft cable had a DB-25 connector on the terminal end.

Table 2-2 DB-25 Craft Cable P/N 458-501788-008

DB-25 female	6 wide modular (RJ-11 type)	Usage
pin 2	pin 3	Transmit Data
pin 3	pin 4	Receive Data
pin 7	pin 5	Signal Ground

Terminal Setup

Set your terminal parameters to:

Data Rate : 19.2 kbit/s

Word Size : 8 bits

Parity : None

Stop Bits : One

Flow Control: None

The Verilink Craft interface does not assert or require any control leads.

Configure Central Site

Use this step-by-step procedure at the central site or whenever an NCM 2000 is used to control one or more QUAD/IMUX installations.

Login

1. Press ENTER. A prompt **pSH+>** appears.
2. Type “craft” and press ENTER. A password prompt appears.

NCM 2000 Main Menu

3. Initially the NCM 2000 has no password for level 2 access. Press ENTER. The NCM 2000 Main Menu appears (Figure 2-2).

Figure 2-2 NCM 2000 Main Menu

```
-- VERILINK NCM CONTROLLER : FW Rev 5.05, Jun 15 1999 12:38:59   --

   Site Name:  Last Shelf                    Access Level:  2
   Managing at NEAR end node [0.0.0.206]          Node ID:  206

                          <- SLOT ->
 SHELF   1   2   3   4   5   6   7   8   9   10  11  12  13
   0     -   -   -   -   -   -   -   -   -   -   -   -   -
   1 M [*N]  -   Q   M   -   -   Q   Q   M   -   -   -   -
   2     -   -   -   -   -   -   -   -   -   -   -   -   -
   3     -   -   -   -   -   -   -   -   -   -   -   -   -
   4     -   -   -   -   -   -   -   -   -   -   -   -   -
KEY: A=didcsu    B=diu/dbu     C=csu   D=diu   E=sdiu  F=diu/dds  G=dhdm
     H=atm/imux  I=idcsu       J=pep   K=dac   L=hlm   M=imux     N=ncm
     P=dpri      Q=quad        R=subrate       S=hsm   T=hdm      U=dcsu
     V=vcu       W= dhdm_poet  X=qpri  Y=as410 ?=unknown

S) shelf/slot                 O) administration
C) configuration              D) diagnostics
P) performance/status         A) alarm
B) circuit manager            I) manufacturing info
X) exit this screen

A [0.0.0.206] [1,1] NCM 2000 >
```

4. Access the NCM Node Administration Menu by typing “O” and pressing ENTER.

Figure 2-3 NCM 2000 Node Administration Menu

```
-- NCM CONTROLLER ADMINISTRATION MENU --

Date/Time/Zone:               79-00-01  18:29:22 PST
Node Address:                 [0.0.0.206]
Node ID:                      206
Site Name:                    Last Shelf
System Uptime:                02:27:49

 --- Node Administration ---

H) set shelf type             Z) set time zone
T) set time                   D) set date
B) download firmware          Y) switch over once
W) write file to flash        O) switch over permanent
C) set front/rear access      Q) query firmware
U) clear card configuration   R) reset card
A) set node address           E) change node id
I) change site name           P) change password
N) network parameters         S) node selection
M) modem parameters
F) flash copy (B => A)
X) exit this screen


A [0.0.0.206] [1,1] NCM 2000 >
```

Set Shelf Type

5. Select the Shelf Type submenu by typing “H” and pressing ENTER. Indicate that you are setting the shelf type for shelf 1 by typing “1” and pressing ENTER.

Figure 2-4 NCM 2000 Node Administration Menu

```
Current Shelf Configuration:
shelf # 0 unset Shelf Type
shelf # 1 2200 QUAD/IMUX Shelf
shelf # 2 unset Shelf Type
shelf # 3 unset Shelf Type
shelf # 4 unset Shelf Type


Shelf Type Selections:
0) unset Shelf Type
1) Dual Line Shelf                2) 2000 Shelf
3) 2200 Shelf                     4) 2900 Shelf

For QUAD_IMUX Applications Use:
50) 2000 QUAD/IMUX Shelf          51) 2200 QUAD/IMUX Shelf
52) 2900 QUAD/IMUX Shelf

Enter shelf (0 - 4): 1
```

6. Set the shelf type to **2200 QUAD/IMUX Shelf** by typing “51”and pressing ENTER. The NCM Node Administration Menu is displayed again. Type “X” and press ENTER to return to the NCM 2000 Main Menu.

NOTE: *When the shelf type selection is any single digit value, the NCM will use Bus A to manage the ACP type modules. When the shelf type selection is any two digit value (such as “51” in this case) the NCM will use shelf Bus C to manage ACP type modules.*

Check Shelf/Slot Map

7. If the NCM 2000 Main Menu now displays each of the QUAD 2164 modules with a **Q** in the correct shelf/slot position, skip the next step and proceed to Step 9.

Set QUAD 2164 ACP Bus to C

8. If any of the QUAD 2164 modules do not appear in the NCM 2000 shelf/slot map, then move the Craft cable sequentially to the port labelled LOCAL on each such module and perform these steps.

   a. Type “craft” and press ENTER.

   b. At the prompt **YOUR PASSWORD?** press ENTER.

   c. At the QUAD 2164 Main Menu type “O” and press ENTER to access the QUAD 2164 Node Administration Menu. Note that the current ACP bus is shown as **A**. Bus A cannot be used to manage all of the modules in an MLS 2200 shelf because the shelf has five segmented A busses. This

configuration requires that the QUAD 2164 modules use Bus C because the NCM is using Bus C (NCM shelf type = 51).

d. At the QUAD 2164 Node Administration Menu type "B" and press ENTER to change the ACP bus. Acknowledge the warning message by typing "y" and pressing ENTER. Type "C" and press ENTER to change the ACP bus to C. A message is displayed indicating that the QUAD 2164 module must now be reset. In a few seconds the Node Administration Menu is re-displayed.

e. Reset the QUAD 2164 module by typing "Y" and pressing ENTER. Type "2" to select flash partition B. The module reboots. Wait for about two minutes until the SYS LED is lit solid green. When all QUAD 2164 modules are assigned to Bus C, return the Craft cable to the LOCAL port on the NCM 2000 and proceed to Step 9.

Configure QUAD 2164

9. Select the QUAD 2164 module in slot 3 of the shelf by typing "S", pressing ENTER, then typing "3" and pressing ENTER.

NOTE: *For the remainder of this chapter you will not be instructed to press* ENTER *after each command. Generally* ENTER *is used after each command, selection, or text entry.*

10. Type "C" to access the QUAD 2164 Configuration Menu.

Figure 2-5 QUAD 2164 Configuration Menu

```
-- QUAD 2164 CONFIGURATION MENU --


                              PORT 1     PORT 2     PORT 3     PORT 4

In)  In Service               NO         NO         NO         NO
Fn)  Frame Format             SF         SF         SF         SF
Ln)  Line Coding              AMI        AMI        AMI        AMI
Bn)  Line Build Out           0db        0db        0db        0db
NDn) Network Density          NONE       NONE       NONE       NONE
NLn) Network Initiated Loop   NO         NO         NO         NO
An)  Alarm Declare Time(sec)  0          0          0          0
DLn) FDL Enable               NO         NO         NO         NO
     PRM Enable               NO         NO         NO         NO

F) FDL configuration
C) copy port                 T) timing
X) exit this screen

A [0.0.0.206] [1,3] QUAD 2164 >
```

NOTE: *Whenever a Verilink Craft interface presents a prompt with an uppercase character and a lowercase "n", the "n" is used as a variable for a port number. Instead of typing "In" to set ports in service, type "I1" for port 1 or "I2" for port 2.*

Configure Port 1

11. Type "I1" and reply "y" to enable port 1.
12. Type "F1"and select "2" for ESF framing.
13. Type "L1" and select "2" for B8ZS. The remaining default options are correct for this example.

Copy Port 1 to All

14. Type "C" to access the **copy port** function. Select port "1" as the port to copy from. Select "A" to copy to all ports. Confirm that you are sure with "y". After the copy operation completes (about 3 seconds), the QUAD 2164 Configuration Menu is re-displayed with all four T1 ports set the same.

Setup Shelf Timing

15. Still at the QUAD 2164 Configuration Menu, type "T" to access the timing submenu. If **Receive clock from shelf** is set to NO, as in Figure 2-6, use the R command and set it to yes. Once **Receive clock from shelf** is set to yes, proceed to Step 16. All QUAD/IMUX applications in a given shelf must share a common clock source.

Figure 2-6 QUAD 2164 Timing Menu

```
-- QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current card timing source:  INTERNAL (PRIMARY)

Source       Synchronization   Auto Restore

PRIMARY       PS) INTERNAL       PA) NO

SECONDARY     SS) INTERNAL       SA) NO

TERTIARY      TS) INTERNAL       TA) NO

R) Receive clock from shelf:  NO
X) exit this screen

A [0.0.0.206] [1,3] QUAD 2164 >
```

16. This example configuration has three QUAD 2164 modules which each connect to the same carrier, and that carrier is providing timing. We will set the configuration so that the shelf can time from the first T1 on any of these three modules. Use the “PC”, “PS”, “PA”, “SC”, “SS”, “SA”, “TC”, “TS” and “TA” commands to set all of the values shown in Figure 2-7. Then exit from the Timing Menu with “X” and exit from the Configuration Menu by using “X”again.

Figure 2-7 QUAD 2164 Timing Menu - Required Settings

```
-- QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current shelf timing source: Card 3, NET 1 (PRIMARY)

Source       Slot Number   Synchronization   Auto Restore

PRIMARY       PC) 3        PS) NET 1       PA) YES

SECONDARY     SC) 7        SS) NET 1       SA) YES

TERTIARY      TC) 8        TS) NET 1       TA) YES

R) Receive clock from shelf:  YES
X) exit this screen

A [0.0.0.206] [1,3] QUAD 2164 >
```

17. Repeat Step 10 through Step 15 for the two remaining QUAD 2164 modules.

Configure Alarm Reporting and Line Restoral

It is *crucial* that the alarm and line restoral options are set as part of the installation process. Otherwise, when a T1 fails and is automatically removed from service by the IMUX 2160, after the alarm condition clears, the previously failed T1 will never be placed back into service. The step-by-step procedure continues below with the QUAD 2164 Alarm and Line Restoral options.

18. Select the QUAD 2164 in slot 3 as the current module, as indicated by the command line prompt. Use the “S” command to change to slot 3, if necessary.

19. From the Main Menu, use “A” to access the QUAD 2164 Alarm Menu. On the Alarm Menu use the “A” command to enable card alarm reporting.

Figure 2-8 QUAD 2164 Alarm Menu

```
-- QUAD 2164 CONFIGURATION MENU (ALARM OPTIONS)--

N) NMS Address:          128.0.0.0
D) Alarm declare time:   1
A) Card Alarm Reporting: NO

O) Display Alarm Buffer       L) Configure Line Restore
X) exit this screen

A [0.0.0.206] [1,3] QUAD 2164 >
```

20. Type “L” to select the Line Restoral Menu.

Figure 2-9 QUAD 2164 Line Restoral Menu

```
   --- QUAD 2164 LINE REMOVE/RESTORE CONFIGURATION MENU ---


                              PORT 1     PORT 2     PORT 3     PORT 4

Pn)  Alarm Reporting          NO         NO         NO         NO
Ln)  Line Restoral            OFF        OFF        OFF        OFF
Cn)  CRC Threshold            0          0          0          0
Sn)  SES Threshold            0          0          0          0
Un)  UAS Threshold            0          0          0          0
Bn)  BER Threshold            DISABLE    DISABLE    DISABLE    DISABLE
Tn)  TOD HH:MM                00:00      00:00      00:00      00:00
In)  Clear Interval           0          0          0          0

X) exit this screen

A [0.0.0.206] [1,3] QUAD 2164 >
```

21. Use the “P1”, “P2”, “P3”, and “P4” commands to enable alarm reporting for all 4 ports.

22. The default value for Line Restoral, **OFF**, selects a mode in which failed T1 circuits are never restored to service. This is unlikely to be desirable. One of the alternate values, **MANUAL**, has exactly the same effect—since a failed and then recovered T1 is never restored to service until a different value is selected. The value **AUTO** is preferable because a failed T1 is placed back into service when it has been clear of trouble for the number of seconds indicated in the **Clear Interval** field. Use the ”L1”, “L2”, “L3”, and “L4” commands to set all four T1 circuits to **AUTO** for Line Restoral.

23. Use the “I1”, “I2”, “I3”, and “I4” commands to set the Clear Interval to 30 seconds. Now, if a T1 fails, the IMUX 2160 will stop using that T1 (as it always does) and only resume using it when the T1 failure has been resolved for 30 seconds. Type “X” twice to return to the Main Menu for the QUAD 2164.

24. Repeat Step 19 through Step 23 for the two remaining QUAD 2164 modules in slots 7 and 8.

Configure the IMUX 2160s

1. From the Main Menu use the “S” command to navigate to slot 4 where the first IMUX 2160 resides. Use the “C” command to access the IMUX 2160 Configuration Menu.

Figure 2-10 IMUX 2160 Configuration Menu

```
-- IMUX 2160 CONFIGURATION MENU --

FW Rev          :   1.28
L) Line Type    :   T1                DSR) NO
C) Channel Rate:    64K               CTS) NO
R) Rx Clk Phase:    INVERT            DCD) YES
T) Tx Clk Phase:    INVERT            TM)  NO
F) Ref Clk Phase:   NORMAL
H) DTE Handshake:   AUTOMATIC
   DTE Type:        V.35
Q1) Quad Card 1:
Q2) Quad Card 2:

                     1  2  3  4  5  6  7  8
Lines Equipped:
Lines Active:
Frame Sync:
CTS Received:
CRC Error:
Far CRC Error:

X) main menu

A [0.0.0.206] [1,4] IMUX 2160 >
```

2. The **Line Type** of T1 is correct for this example. 64K is the correct setting for **Channel Rate** when a B8ZS T1 is used.

NOTE: *When* **Rx Clock** *is set to “INVERT” the clock signal is actually normal. When* **Rx Clock** *is set to “NORMAL” the clock signal is actually inverted. When* **Tx Clock** *is set to “INVERT” the clock signal is actually normal. When* **Tx Clock** *is set to “NORMAL” the clock is actually inverted.*

3. Use the “H” command to select MANUAL for DTE handshaking. Use the “DSR”, “CTS” and “DCD” commands to force these control leads on.

NOTE: *Whenever DTE Handshake is set to MANUAL, all of the vital control leads required to pass data are immediately forced off. Even if these leads have been previously forced ON, if DTE Handshake is toggled to AUTOMATIC and then back to MANUAL, all of the vital leads are forced off, absolutely preventing data transmission. Whenever DTE Handshake is set to MANUAL the user should force on DSR, CTS and DCD.*

---

4. The “RI” command refers to Ring Indicator, a control lead used on RS-232 dial modems that has no bearing on this product. Forcing “RI” on has no effect on any lead and forcing “RI” off has no effect on any lead.

5. Force “TM” on if you wish to falsely indicate to the DTE that the IMUX 2160 is always in a test mode, even when it is not in a test mode, or force “TM” off if you wish to falsely indicate that the IMUX 2160 is never in a test mode, even when it is in a test mode.

NOTE: *Whenever any control lead must be forced on in an IMUX 2160 the user must select the DTE Handshake setting “MANUAL”. This causes all of the control leads to be forced off. The user must then force ON all of the control leads which are required. It is not possible to have one control lead forced on while other control leads continue to function normally. In addition, DSR must be on or the IMUX 2160 will not transmit any user data.*

---

6. The Q1 command is used to select T1 ports on the first QUAD 2164. This module must be installed in an odd-numbered slot of the shelf. Type “Q1” and then enter “1,2,3,4” to select all 4 of the T1 ports. Connect the four T1 circuits to the network ports on the rear connector module behind the QUAD 2164. Document which T1 circuit has been connected to which port, since one-to-one alignment of the T1 ports is required at each site. (The T1 connected to port 1 at the central site must be connected to port 1 at the remote site, and so forth.)

7. Repeat steps 1 through 6 of this (IMUX 2160) procedure for the IMUX 2160 module in slot 9. Because the IMUX 2160 in slot 9 will be using two QUAD 2164 modules, use the “Q2” command as well and enter “1,2,3,4” to select all four T1 circuits on the QUAD 2164 module in slot 8.

Central Site Summary

This concludes the necessary steps to begin passing data at the central site. Other actions which would be typical might include setting a TCP/IP address for management purposes. Please see the *NCM 2000 User Manual* for details on configuring the NCM 2000.

Until now, all of the menu screen shots in this chapter have been those seen by using the Craft interface of the NCM 2000. The two remote sites in this example configuration do not feature an NCM 2000. For the balance of this chapter the menus presented and command examples given will be those obtained by connecting directly to the Craft interface of the QUAD 2164 module.

Remote Site Configuration

This section details the procedure for configuring a standalone QUAD/IMUX configuration—one without an NCM 2000. In the "Example Network" section at the beginning of this chapter the first remote site was described as consisting of a QUAD 2164 module and an IMUX 2160 module in a Dual-line shelf. We will configure that site first.

Login

Follow the procedure given in this chapter in the section Connect a Terminal to connect to the node, except connect the Craft cable to the LOCAL port on the QUAD 2164.

1. Press ENTER. A prompt **pSH+>** appears.
2. Type "craft" and press ENTER. A password prompt appears. Initially there is no password, press ENTER to continue. The QUAD 2164 Main Menu appears.

Figure 2-11 QUAD 2164 Main Menu

```
-- VERILINK ACE CONTROLLER at [1,1]: FW Rev 4.30, Oct 12 1998  --

Site Name:
Access level:  4
                          <- SLOT ->
 SHELF   1   2   3   4   5   6   7   8   9   10  11  12  13
   0     -   -   -   -   -   -   -   -   -   -   -   -   -
   1 D  [Q]  M
   2     -   -   -   -   -   -   -   -   -   -   -   -   -
   3     -   -   -   -   -   -   -   -   -   -   -   -   -
   4     -   -   -   -   -   -   -   -   -   -   -   -   -
   5     -   -   -   -   -   -   -   -   -   -   -   -   -
   6     -   -   -   -   -   -   -   -   -   -   -   -   -
   7     -   -   -   -   -   -   -   -   -   -   -   -   -
   8     -   -   -   -   -   -   -   -   -   -   -   -   -
KEY: *=CONTROLLER N=NCM Q=QUAD M=IMUX A=DIDCSU U=DCSU P=DPRI

S) shelf/slot                 O) node administration
M) enable alarm monitor       A) display alarm buffer
C) configuration              D) diagnostics
P) performance/status         B) circuit
X) system log off

[1,1] QUAD 2164 >
```

WARNING Never configure any SLIP IP address through the Craft interface of a QUAD 2164 module (firmware versions 4.30 or lower). There is no RS-232 interface for use with SLIP—and the module WILL fail, requiring factory repair, if the SLIP address conflicts with the Ethernet address.

3. Type “C” to access the QUAD 2164 Configuration Menu.

Figure 2-12 QUAD 2164 Configuration Menu

```
--  QUAD 2164 CONFIGURATION MENU --


                              PORT 1     PORT 2     PORT 3     PORT 4

In)  In Service               NO         NO         NO         NO
Fn)  Frame Format             SF         SF         SF         SF
Ln)  Line Coding              AMI        AMI        AMI        AMI
Bn)  Line Build Out           0db        0db        0db        0db
NDn) Network Density          NONE       NONE       NONE       NONE
NLn) Network Initiated Loop   NO         NO         NO         NO
DLn) FDL Enable               NO         NO         NO         NO
     PRM Enable               NO         NO         NO         NO

F) FDL configuration          A) alarm configuration
C) copy port                  D) restore defaults
T) timing                     X) exit this screen

[1,1] QUAD 2164 >
```

Configure Port 1

4. Type “I1” and reply “y” to enable port 1.
5. Type “F1”and select “2” for ESF framing.
6. Type “L1” and select “2” for B8ZS. The remaining default options are correct for this example.

Copy Port 1 to All

7. Type “C” to access the **copy port** function. Select port “1” as the port to copy from. Select “A” to copy to all ports. Confirm that you are sure with “y”. After the copy operation completes (about 3 seconds), the QUAD 2164 Configuration Menu is re-displayed with all four T1 ports set the same.

Setup Shelf Timing

8. Still at the QUAD 2164 Configuration Menu, type “T” to access the timing submenu. If **Receive clock from shelf** is set to NO, use the R command and set it to "yes". Once **Receive clock from shelf** is set to "yes", proceed to Step 9. All QUAD/IMUX applications in a given shelf must share a common clock source.

Figure 2-13 QUAD 2164 Timing Menu

```
--  QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current shelf timing source: Card 1, NET 1

Source       Slot Number   Synchronization   Auto Restore

PRIMARY       PC) 1        PS) NET 1       PA) YES

SECONDARY     SC) 1        SS) NET 2       SA) YES

TERTIARY      TC) 1        TS) NET 3       TA) YES

R) Receive clock from shelf:  YES
X) exit this screen

[1,1] QUAD 2164 >
```

9. This site has one QUAD 2164 module which connects to four T1 circuits from the same carrier, and that carrier is providing timing. We will set the configuration so that the shelf can time from any of the first three T1 circuits. Use the “PC”, “PS”, “PA”, “SC”, “SS”, “SA”, “TC”, “TS” and “TA” commands to set all of the values shown in Figure 2-13 (above). Then exit from the Timing Menu with “X” and use the “A” command to access the Alarm Configuration Menu.

Figure 2-14 QUAD 2164 Alarm Configuration Menu

```
--  QUAD 2164 CONFIGURATION MENU (ALARM OPTIONS)--

N) NMS Address:          128.0.0.0
D) Alarm declare time:   1
A) Card Alarm Reporting: NO

                              PORT 1     PORT 2     PORT 3     PORT 4

Pn)  Alarm Reporting          NO         NO         NO         NO
Ln)  Line Restoral            OFF        OFF        OFF        OFF
Cn)  CRC Threshold            0          0          0          0
Sn)  SES Threshold            0          0          0          0
Un)  UAS Threshold            0          0          0          0
Bn)  BER Threshold            DISABLE    DISABLE    DISABLE    DISABLE
Tn)  TOD HH:MM                00:00      00:00      00:00      00:00
In)  Clear Interval           0          0          0          0

 X)  exit this screen

[1,1] QUAD 2164 >
```

Configure Line Restoral

10. Type “A” and select “2” to enable card alarm reporting.

11. Use “P1”, “P2”, “P3”, and “P4” to enable alarm reporting on each of the T1 ports.

12. Use “L1”, L2”, “L3”, and “L4” and select “2” for each to enable automatic line restoral.

NOTE: *If you do not change the line restoral option to either* **AUTO** *or* **TOD**, *then any T1 circuit which fails will not be placed back into service again after the outage has cleared.*

13. Use “I1”, “I2”, “I3”, and “I4” to set the minimum length of time that a previously failed T1 must be error free before the IMUX 2160 begins using it again. Use a value of “30” for 30 seconds.

Configure IMUX 2160

14. Use “X” twice to return to the QUAD 2164 Main Menu. Type “S” and indicate shelf “1” and slot “2” to navigate to the IMUX 2160. Type “C” to access the IMUX 2160 Configuration Menu.

Figure 2-15 IMUX 2160 Configuration Menu

```
--  IMUX 2160 CONFIGURATION MENU --

L) Line Type   :   T1               1) DSR NO
C) Channel Rate:   64K              2) CTS NO
R) Rx Clk Phase:   INVERT           3) DCD YES
T) Tx Clk Phase:   INVERT           4) RI YES
F) Ref Clk Phase:  NORMAL           5) TM NO
H) DTE Handshake:  AUTOMATIC
   DTE Type:       V.35
Q1) Quad Card 1:   1
Q2) Quad Card 2:

                    1  2  3  4  5  6  7  8
Lines Equipped:     X
Lines Active:
Frame Status:
CTS Status:
CRC Status:
Far CRC Status:

X) main menu

[1,2] IMUX 2160 >
```

15. The **Line Type** of T1 is correct for this example. 64K is the correct setting for **Channel Rate** when a B8ZS T1 is used.

NOTE: *When* **Rx Clock** *is set to "INVERT" the clock signal is actually normal. When* **Rx Clock** *is set to "NORMAL" the clock signal is actually inverted. When* **Tx Clock** *is set to "INVERT" the clock signal is actually normal. When* **Tx Clock** *is set to "NORMAL" the clock is actually inverted.*

16. Use the "H" command to select MANUAL for DTE handshaking. Use the "DSR", "CTS" and "DCD" commands to force these control leads on.

NOTE: *Whenever DTE Handshake is set to MANUAL, all of the vital control leads required to pass data are immediately forced OFF. Even if these leads have been previously forced ON, if DTE Handshake is toggled to AUTOMATIC and then back to MANUAL, all of the vital leads are forced off again, absolutely preventing data transmission. Whenever DTE Handshake is set to MANUAL, the user must force on DSR, CTS and DCD.*

17. The "RI" command refers to Ring Indicator, a control lead used on RS-232 dial modems that has no bearing on this product. Forcing "RI" on has no effect on any lead and forcing "RI" off has no effect on any lead.

18. Force "TM" on if you wish to falsely indicate to the DTE that the IMUX 2160 is always in a test mode, even when it is not in a test mode, or force "TM" off if you wish to falsely indicate that the IMUX 2160 is never in a test mode, even when it is in a test mode.

NOTE: *Whenever any control lead must be forced on in an IMUX 2160 the user must select the DTE Handshake setting "MANUAL". This causes all of the control leads to be forced off. The user must then force ON all of the control leads which are required. It is not possible to have one control lead forced on while other control leads continue to function normally. In addition, DSR must be on or the IMUX 2160 will not transmit any user data.*

19. The Q1 command is used to select T1 ports on the first QUAD 2164. This module must be installed in an odd-numbered slot of the shelf. Type "Q1" and then enter "1,2,3,4" to select all 4 of the T1 ports.

20. Connect the four T1 circuits to the network ports on the rear connector module behind the QUAD 2164. Be sure to connect the same T1 circuit to net port 1 as was done at the central site.

21. Observe the port LEDs on the front panel of the QUAD 2164 module. Each LED should turn green within 15 seconds of connecting the T1. Troubleshoot any T1 problems until both ends of the circuit display green LEDs for all T1s.

22. Press ENTER to refresh the display of the IMUX 2160 Configuration Menu. A column of **X** characters should appear under each T1 circuit which is being used by the IMUX 2160. See Figure 2-16.

Figure 2-16 IMUX 2160 Using Four T1 Circuits

```
--  IMUX 2160 CONFIGURATION MENU --

L) Line Type   :   T1                1) DSR NO
C) Channel Rate:   64K               2) CTS NO
R) Rx Clk Phase:   INVERT            3) DCD YES
T) Tx Clk Phase:   INVERT            4) RI YES
F) Ref Clk Phase:  NORMAL            5) TM NO
H) DTE Handshake:  AUTOMATIC
   DTE Type:       V.35
Q1) Quad Card 1:   1 2 3 4
Q2) Quad Card 2:

                    1  2  3  4  5  6  7  8
Lines Equipped:     X  X  X  X
Lines Active:       X  X  X  X
Frame Status:       X  X  X  X
CTS Status:         X  X  X  X
CRC Status:
Far CRC Status:

X) main menu

[1,2] IMUX 2160 >
```

Second Remote Site

23. Repeat steps 1 through 22 of this procedure at the second remote site. Because the second site uses eight T1 circuits instead of four—at the IMUX 2160 Configuration Menu, after using the "Q1" command as in Step 19—also type "Q2" and enter "1,2,3,4" to select the T1 circuits on the second QUAD 2164.

Chapter 3

E1 Configuration Menus

The menus included in this chapter apply to a standalone configuration. The same menus are available from the Node Controller Module (NCM 2000), although options may display in a different format. For more information on the NCM 2000, see the *NCM 2000 User Manual*.

Node Management

There are three node management options for the QUAD 2164.

- Craft interface (by direct connection to the LOCAL port or via Telnet over Ethernet)
- Node Manager (requires NCM 2000)
- SNMP

This chapter uses the Craft interface. For more information on using Node Manager, see the *Node Manager User Guide*. For more information on NCM, see the *NCM 2000 User Manual*. For more information on using SNMP, see your SNMP documentation.

Craft Interface

To access the Craft interface use an ASCII terminal emulator connected to the QUAD 2164 LOCAL port. Set your terminal emulation to match the following values:

- 19,200 data rate
- 8 data bits
- No parity
- No flow control

1. Press ENTER
2. At the **pSH+>** prompt type “craft” and press ENTER.
3. At the **password** prompt press ENTER (default password).

The QUAD 2164 Main Menu is displayed (Figure 3-1).

Figure 3-1 Quad 2164 Main Menu

```
-- VERILINK ACE CONTROLLER at [1,1]: FW Rev 4.30, Oct 12 1998  --

Site Name:
Access level:  4
                            <- SLOT ->
 SHELF   1   2   3   4   5   6   7   8   9   10  11  12  13
   0     -   -   -   -   -   -   -   -   -   -   -   -   -
   1 D  [*Q] M
   2     -   -   -   -   -   -   -   -   -   -   -   -   -
   3     -   -   -   -   -   -   -   -   -   -   -   -   -
   4     -   -   -   -   -   -   -   -   -   -   -   -   -
   5     -   -   -   -   -   -   -   -   -   -   -   -   -
   6     -   -   -   -   -   -   -   -   -   -   -   -   -
   7     -   -   -   -   -   -   -   -   -   -   -   -   -
   8     -   -   -   -   -   -   -   -   -   -   -   -   -
KEY: *=CONTROLLER N=NCM Q=QUAD M=IMUX A=DIDCSU U=DCSU P=DPRI

S) shelf/slot                  O) node administration
M) enable alarm monitor        A) display alarm buffer
C) configuration               D) diagnostics
P) performance/status          B) circuit
X) system log off

[1,1] QUAD 2164 >
```

Table 3-1 Main Menu Commands

Command	Description
S	Shelf/slot—See Shelf/Slot Selection in this chapter.
M	Enable Alarm Monitor—See Chapter 5, "*Performance Monitoring*".
C	Configuration—See E1 QUAD Configuration Menu in this chapter.
P	Performance/status—See Chapter 5, "*Performance Monitoring*".
O	Node Administration—See E1 Node Administration, in this chapter.
A	Display Alarm Buffer—See Chapter 5, "*Performance Monitoring*".
D	Diagnostics—See Chapter 6, "*Diagnostics*".
B	Circuit—Not supported by the QUAD/IMUX product.
X	System Log Off

Shelf/Slot Selection

To select a shelf and slot to manage, type "S" and press ENTER. Type the shelf number of the desired module and press ENTER. Type the slot number and press ENTER again. The screen updates to display the selected shelf and slot in **[ ]** brackets. In Figure 3-1 the QUAD 2164 module in shelf 1, slot 1 is the selected card.

E1 QUAD Configuration Menu

To configure the QUAD 2164 E1 options, select the QUAD shelf and slot, and type "C". The QUAD 2164 Configuration Menu is displayed (Figure 3-2).

Figure 3-2 E1 QUAD 2164 Configuration Menu

```
--  QUAD 2164 CONFIGURATION MENU --

                              PORT 1     PORT 2     PORT 3     PORT 4

In)  In Service               YES        YES        YES        YES
En)  CRC4                     NO         NO         NO         NO
Fn)  Carrier Failure Alarm    NO         NO         NO         NO
Sn)  FASE Alarm Category      MINOR      MINOR      MINOR      MINOR
Mn)  Framing Mode             CAS        CAS        CAS        CAS
Nn)  Alarm Declare Time(sec)  0          0          0          0
Pn)  Idle pattern             0000       0000       0000       0000

A) alarm configuration
C) copy port                  D) restore defaults
T) timing                     X) exit this screen
```

NOTE: *Option command letters/numbers followed by an n indicates a variable number/letter replaces the n. For example, in Figure 3-2 the* In Service *menu option is In. Where n = port numbers 1, 2, 3, or 4. To put port 1 into service the menu option would be "I1".*

Table 3-2 E1 QUAD 2164 Configuration Menu

Command	Description
I*n*	In Service—Use this option to put the selected port in service or take it out of service. Specify "Yes" or "No".
E*n*	CRC4—(Cyclic Redundancy Check) is an error-checking algorithm performed on data transmissions. On a frame-by-frame basis, a numerical value is derived from the data in the bit stream at one end of transmission. When each frame reaches the receive end, the cyclic redundancy check is calculated again and compared with the value generated by the transmit-side data. Discrepancies generally indicate one or more transmission errors. Specify "Yes" or "No".
F*n*	Carrier Failure Alarm—CFA is an alarm sent from the node indicating an E1 port has exceeded the Loss of Frame and the Loss of Signal seconds threshold set in the Net Port Alarm Configuration Menu. When enabled, an alarm is generated at the node and an Alarm Indication Signal (AIS) alarm is sent down stream to the other node. Specify "Yes" or "No".
S*n*	FASE Alarm Category—Set this option to specify the Frame Alignment Signal Error (FASE) Alarm Category: This alarm indicates the number of FAS errors has exceeded 10^{-3}. A FAS bit error occurs in bits 2-8 of an FAS frame and bit 2 of a non-FAS frame. A minor FASE alarm is indicated by a yellow light on the LED. A major FASE alarm is indicated by a red light on the LED, and the alarm relay is turned on. Valid options are: 1) Minor 2) Major

Command	Description
M*n*	Framing Mode—Select the type of framing which matches the E1 framing supplied by the carrier. Options are: 1) CAS (Channel Associated Signaling) 2) CCS (Common Channel Signaling) 3) 31 CHANNEL (E1 framing parameter) 4) G703 (ITU-T specification) 31 Channel is the default. Only CAS and 31 Channel are supported.
N*n*	Alarm Declare Time (sec)—Use this option to indicate how many seconds will elapse before a message regarding a problem is recorded to the alarm buffer. The range is 0-127 seconds.
P*n*	Idle Pattern—The idle pattern is a code that is transmitted when there is no user data on the net. The range is 0 to 15. The entered value is converted to binary code.
A	Alarm Configuration—Refer to E1 Alarm Options on page 3-4.
C	Copy Port—Copies the configuration settings from one port to another or all.
D	Restore Defaults—Restores the port parameter settings to their default values.
T	Timing—Refer to E1 Alarm Options, on page 3-4.
X	Exit this screen—Use this option to return to the Main Menu.

E1 Alarm Options

To configure the QUAD 2164 Alarm Options, type "A" from the QUAD 2164 Configuration Menu (Figure 3-2). The QUAD 2164 Alarm Options menu appears (Figure 3-3).

Figure 3-3 E1 Alarm Options Menu

```
--  QUAD 2164 CONFIGURATION MENU (ALARM OPTIONS)--

N) NMS Address:          128.0.0.0
D) Alarm declare time:   1
A) Card Alarm Reporting: YES
L) Configure Line Restore       T) Configure Threshold Group A
X) exit this screen             U) Configure Threshold Group B
```

Table 3-3 E1 Alarm Options Menu

Command	Description
N	NMS Address—Displays the Verilink ACP address for Node Manager (address of the PC that receives the alarms). This is not a TCP/IP address, although it uses the same four octet structure. The first octet of this number must never be lower than 128.
D	Alarm Declare Time—Indicates how many seconds will elapse before a message regarding a problem is recorded in the alarm buffer.
A	Card Alarm Reporting—Use this option to enable or disable alarms reported from the card to the alarm buffer and screen display (if enabled).
L	Configure Line Restore—If you plan to use the line restoral features of the QUAD/IMUX cards, use this option and then use Threshold Group A and Group B options to configure the line restoral thresholds and alarm parameters.
T	Configure Threshold Group A—If you plan to use the line restoral features of the QUAD/IMUX cards, use this option, the Configure Threshold Group B option, and the Configure Line Restore option to configure the line restoral thresholds and alarm parameters.

Command	Description
U	Configure Threshold Group B—If you plan to use the line restoral features of the QUAD/IMUX cards, use this option, the Configure Threshold Group A option, and the Configure Line Restore option to configure the line restoral thresholds and alarm parameters.
X	Exit this screen—Use this option to return to the Configuration menu.

E1 Line Remove and Restore Menu

To configure the Line Restoral Options, type "L" from the QUAD 2164 Configuration Menu, Alarm Options display (Figure 3-4). The QUAD 2164 Line Remove/Restore Configuration Menu appears.

Use this option to remove the port from service under conditions of excessive CRC, SES, UAS, BPV, or BER errors on each network port. The line is removed whenever a configured error threshold is exceeded. (The line is also taken out of service immediately if LOS, LOF, AIS, RAI, and BPV are detected.)

CRC thresholds are monitored every second. SES and UAS thresholds are monitored over 15-minute intervals. BER thresholds are monitored over predetermined periods for each BER selection. (11 minutes for BER $10E^{-9}$ and 1.5 minutes for $10E^{-8}$.)

The line remains out of service until the error condition clears. (Some conditions, for example, SES and UAS can take up to fifteen minutes to clear.) When the failed line is restored, the QUAD/IMUX card starts a 15-minute timer. If this timer expires without further line failures, any subsequent failure will be treated as a new failure. However, if a failure occurs before the 15-minute timer expires, the line remains out of service for the number of minutes specified in the Clear Interval parameter (see below).

Line Restoral options are:

- **Off** means that a failed line will never be restored until a different option is selected. In effect, it is identical to **Manual**.
- **Manual** means that a failed line will never be restored until a different option is selected. In effect, it is identical to **Off**.
- **Automatic** means a failed line will be restored to service when the failure clears and the line remains available for the length of time (in seconds) in the **Clear Interval** value.
- **TOD** specifies a time of day that a line removed from service will be restored.

Figure 3-4 E1 Line Remove/Restore Configuration Menu

```
--  QUAD 2164 LINE REMOVE/RESTORE CONFIGURATION MENU --


                              PORT 1     PORT 2     PORT 3     PORT 4

Ln)  Line Restoral            AUTO       AUTO       AUTO       AUTO
Cn)  CRC Threshold            0          0          0          0
Sn)  SES Threshold            0          0          0          0
Un)  UAS Threshold            0          0          0          0
Bn)  BER Threshold            DISABLE    DISABLE    DISABLE    DISABLE
Tn)  TOD HH:MM                00:00      00:00      00:00      00:00
In)  Clear Interval           900        900        900        900
```

Table 3-4 E1 Line Remove/Restore Configuration Menu

Command	Description
L*n*	Line Restoral—Use this option to remove the port from service under conditions of excessive CRC, SES, UAS, BPV, or BER errors on each network port. The line will be removed whenever a configured error threshold is exceeded. (The line will also be taken out of service immediately if LOS, LOF, or AIS, are detected.)
C*n*	CRC Threshold—Use this option to specify the maximum number of CRC errors that can occur before the line is removed from service.
S*n*	SES Threshold—Use this option to specify the maximum number of Severely Errored Seconds errors that can occur before the line is removed from service.
U*n*	UAS Threshold—Use this option to specify the maximum number of Unavailable Seconds errors that can occur before the line is removed from service.
B*n*	BER Threshold—Use this option to specify the maximum number of Bit Error Rate errors that can occur before the line is removed from service.
T*n*	TOD HH:MM—Use this option to set the time of day in hours and minutes when a line removed from service should be restored.
I*n*	Clear Interval—Use this option to specify how long a line removed from service for the second time during a monitored period, should stay out of service before attempting restoral. See Line Restoral above for more information. Verilink recommends that you set the Clear Interval parameter to 900 seconds (15-minutes).
X	Exit this screen—Use this option to return to the Configuration menu.

Copy Port Options

To copy the configuration settings from one port to another, type "C" from the QUAD 2164 Configuration Menu. The QUAD 2164 copy port options appears.

E1 Timing Options

To configure the QUAD 2164 timing options, type "T" from the QUAD 2164 Configuration Menu. The QUAD 2164 Timing Options menu appears (Figure 3-5).

Figure 3-5 E1 Timing Options Menu

```
--  QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current shelf timing source: Card 1, INT

Source       Slot Number   Synchronization   Auto Restore

PRIMARY      PC) 2         PS) INT           PA) YES

SECONDARY    SC) 2         SS) INT           SA) YES

TERTIARY     TC) 2         TS) INT           TA) YES

R) Receive clock from shelf:  YES
X) exit this screen
```

Table 3-5 E1 Timing Options Menu

Field Name	Description
PC (Primary) SC (Secondary) TC (Tertiary)	Source—Enter the slot of the module which will be the timing source. (This includes the option of setting your QUAD 2164 as the timing source for the shelf.) Select a primary timing source “PC”, also the secondary “SC” and tertiary timing sources “TC”. The latter two sources provide a backup in case the primary source fails.
PS	Primary Synchronization—Choose one of the following as your primary source for time synchronization. • NET 1: Use this option to synchronize timing to E1 port 1. • NET 2: Use this option to synchronize timing to E1 port 2. • NET 3: Use this option to synchronize timing to E1 port 3. • NET 4: Use this option to synchronize timing to E1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source. • 5) DAT 1: Not available on the QUAD 2164. • 6) DAT 2: Not available on the QUAD 2164.
SS	Secondary Synchronization—Use this option to specify an alternate source of timing for synchronization purposes. In the event that the primary source is unavailable, this source will be used. • NET 1: Use this option to synchronize timing to E1 port 1. • NET 2: Use this option to synchronize timing to E1 port 2. • NET 3: Use this option to synchronize timing to E1 port 3. • NET 4: Use this option to synchronize timing to E1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source. • 5) DAT 1: Not available on the QUAD 2164. • 6) DAT 2: Not available on the QUAD 2164.

Field Name	Description
TS	Tertiary Synchronization—Use this option to specify an alternate source of timing for synchronization purposes. In the event that the primary and secondary source are unavailable, this source will be used. • NET 1: Use this option to synchronize timing to E1 port 1. • NET 2: Use this option to synchronize timing to E1 port 2. • NET 3: Use this option to synchronize timing to E1 port 3. • NET 4: Use this option to synchronize timing to E1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source. • 5) DAT 1: Not available on the QUAD 2164. • 6) DAT 2: Not available on the QUAD 2164.
PA (Primary) SA (Secondary) TA (Tertiary)	Auto Restore—Selects which timing source will be used when the primary timing source fails, restores, and then remains viable for a period of 60 seconds. For example, if the primary source fails, the secondary source becomes the timing source. When the primary source is back in service, and the **Auto Restore** option is set to **Yes**, it resumes as the QUAD 2164 module's timing source. If the Auto Restore option is set to **No**, the secondary source remains the timing source until you manually set the primary source's Auto Restore option to **Yes**.
X	Exit—Use this option to return to the main menu.

E1 Node Administration

The QUAD 2164 Main Menu is the access point for both of the Inverse Multiplexer modules, the QUAD 2164 and IMUX 2160 in a standalone configuration. The QUAD 2164 administrative menu to set the address parameters and perform firmware upgrades.

Beneath the title, the site name and access level of the current user are displayed. The site name is entered in the Node Administration Menu. The access level is determined by the password, with Level 4 at the highest level.

NOTE: *The four levels of passwords are a function of the NCM 2000. The QUAD/IMUX has a one level password. The default password is pressing the* ENTER *key.*

To specify node administration parameters for the selected QUAD 2164 module, type "O" from the QUAD 2164 Main Menu.

Figure 3-6 QUAD 2164 Administration Menu

```
--  ACE CONTROLLER ADMINISTRATION MENU --

Date/Time/Zone:     3-21-98  17:23:50
Node Address:       [123.0.2.6]
Ethernet Type       Ethernet 2
IP Address:         [192.94.45.242]
Sub-net mask:       [255.255.255.0]
Slip Address:       [0.0.0.0]
Slip sub-net mask:  [255.255.255.0]
Trap Addresses:     [0.0.0.0] [0.0.0.0]
                    [0.0.0.0] [0.0.0.0]
Gateway Address:    [0.0.0.0]
Read Community string:
Write Community string:

System uptime:      18:18:48
ACP bus:            C
T) set time                   D) set date
Z) set time zone              A) set node address
N) network parameters         M) modem parameters
R) reset card                 P) change password
Q) query firmware             Y) switch over once
O) switch over permanent      W) write file to flash
I) change site name           B) change ACP bus
C) clear card configuration   X) main menu
```

Figure 3-7 QUAD 2164 Administration Menu, Network Parameters

```
--  ACE CONTROLLER ADMINISTRATION MENU --

Date/Time/Zone:     3-29-98  21:44:51
Node Address:       [not set]
Ethernet Type       Ethernet 2
IP Address:         [0.0.0.0]
Sub-net mask:       [0.0.0.0]
Slip Address:       [0.0.0.0]
Slip sub-net mask:  [0.0.0.0]
Trap Addresses:     [0.0.0.0] [0.0.0.0]
                    [0.0.0.0] [0.0.0.0]
Gateway Address:    [0.0.0.0]
Read Community string:
Write Community string:

System uptime:      0:08:28
ACP bus:            A
I) ethernet ip address        L) slip address
M) ethernet subnet mask       S) slip subnet mask
G) gateway ip address         W) SNMP write community string
T) ethernet type              R) SNMP read community string
Pn) trap addresses            X) back
```

Table 3-6 E1 QUAD 2164 Administration Menu

Command/Field	Description
D) Set Date T) Set Time Z) Set Zone	Date/Time/Zone—This field displays the QUAD 2164 module's current date and time. To change the time zone, type "Z". At the Select Timezone prompt, select, local time, Eastern Standard Time (EST), Central Standard Time (CST), Mountain Standard Time (MST), and Pacific Standard Time (PST). To create your own time zone specification, or to specify a time zone not shown, select custom and enter the necessary information. To change the date, type "D". Enter the new date as the number of the month (01-12), number of the day of the month (01-31), and the last two digits of the current year (e.g., 97). To change the time, type "T". Enter the new time as the number of hours (00-24), number of minutes (00-60), and number of seconds (00-60). ***Note:*** *Set the time zone before setting the time.*
A	Node Address—This field displays the QUAD's node ACP address. To change this address, type "A" and enter a new four-byte address.
1) Ethernet 2 (DIX) 2) 802.3	This field displays the Ethernet framing type configured for the card. To change this specification, type "N" (network parameters), then "T" (ethernet type). If your network uses TCP/IP, select 1) Ethernet 2. See Figure 3-7.
IP Address	This field displays the IP address for the card. To change this address, type "N" (network parameters), then "I" (Ethernet IP address). See Figure 3-7.
Sub-net Mask	This field displays the Ethernet sub-net mask for the card. To change this value, type "N" (network parameters), then "M" (Ethernet subnet mask). See Figure 3-7.

Command/Field	Description
Slip Address	Do not configure SLIP on the QUAD 2164. There is no physical interface on the QUAD 2164 which supports SLIP. Errors made while configuring SLIP may lockup the module, requiring factory repair.
Slip Sub-net Mask	Do not configure SLIP on the QUAD 2164. There is no physical interface on the QUAD 2164 which supports SLIP. Errors made while configuring SLIP may lockup the module, requiring factory repair.
Trap Addresses	This field displays the SNMP trap IP addresses for each port. To change this address, type "N" (network parameters), then "P*n*" (trap addresses), where *n* is the number of the QUAD port. See Figure 3-7.
Gateway Address	This field displays the IP address of the node's gateway. To change this address, type "N" (network parameters), then "G" (gateway ip address). See Figure 3-7.
Read Community String	This field displays the SNMP community read string state. To change this state, type "N" (network parameters), then R (SNMP read community string). Sample strings include NETMGT and PUBLIC. See Figure 3-7.
Write Community String	This field displays the SNMP community write string state. To change this state, type "N" (network parameters), then "W" (SNMP write community string). Sample strings include NETMGT and PUBLIC. See Figure 3-7.
System Uptime	This field displays the amount of time (in hours, minutes, and seconds) that the node has been operating. It resets to zero every time the node is rebooted.
N	Network Parameters—Use this field to change any of the network parameters displayed on the Administration Menu.
M	Modem Parameters—Not available with this product.
R	Reset Card—Returns the QUAD 2164 module to its factory default values. Press "Y" to confirm this action.
P	Change Password—Sets privileged and unprivileged passwords. At the Password Menu, type "P" to set privileged passwords. Type "U" to set unprivileged passwords. Privileged users have network administrator permissions and can change all parameters. Unprivileged users have run time access to QUAD 2164 module capabilities, but cannot make changes to parameters.
Q	Query Firmware—Verifies the status of the firmware and memory in the active partition (A or B). When you type "Q', the screen reports the version level and status of the partition firmware and RAM.
Y	Switch Over Once—Switches the active firmware partition (used typically to test new firmware). At the prompt, select the partition (A or B) to switch to temporarily. When you reboot the card, the original partition will be used.
O	Switch Over Permanent—Permanently switches the active firmware partition. At the prompt, select the partition (A or B) to switch to permanently. When you reboot the card, this new partition is used as the boot partition.
W	write File to Flash—Updates the flash image in the nonactive partition. Requires overwrite confirmation of the nonactive partition.
B	Change ACP Bus—Changes the ACP communications bus. Reset the card after the change is made.
X	Main Menu—Return to the main menu.

IMUX Configuration

This section provides information about the E1 IMUX 2160 module configuration.

E1 IMUX Configuration Menu

To display the Configuration Menu, select an IMUX 2160 module from the Main Menu and type "C" for configuration. The E1 IMUX Configuration Menu is displayed (Figure 3-8).

Figure 3-8 E1 IMUX Configuration Screen

```
--  IMUX 2160 CONFIGURATION MENU --

L) Line Type   :   E1                1) DSR NO
C) Channel Rate:   64K               2) CTS NO
R) Rx Clk Phase:   NORMAL            3) DCD YES
T) Tx Clk Phase:   INVERT            4) RI YES
F) Ref Clk Phase:  NORMAL            5) TM NO
H) DTE Handshake:  AUTOMATIC
   DTE Type:       HSSI
Q1) QUAD Card 1:   1 2 3 4
Q2) QUAD Card 2:

                    1  2  3  4  5  6  7  8
Lines Equipped:     X  X  X  X
Lines Active:       X  X  X  X
Frame Status:       X  X  X  X
CTS Status:         X  X  X  X
CRC Status:
```

NOTE: *Careful consideration must be given to the selection for DTE handshake. If MANUAL is selected, every control lead is immediately forced off. This absolutely prevents data transmission. In MANUAL DTE Handshake mode DSR must be forced on or no data will be transmitted. In AUTOMATIC mode the DTE must assert DTR or DSR will not be returned and no data will be transmitted.*

Table 3-7 E1 IMUX Configuration Menu

Command/Field	Description
L	Line Type—Use this field to select the line configuration. Valid choices are E1 or T1.
C	Channel Rate—Use this field to select the data rate per DS0. Valid choices are 64K and 56K. 64K is the preferred option for E1.
R	Rx Clk Phase—Use this field to select the phase relationship of receive clock and receive data. Valid choices are Normal and Inverted.
T	Tx Clk Phase—Use this field to select the phase relationship of transmit clock and transmit data. Valid choices are Normal and Inverted.

Command/Field	Description
F	Ref Clk Phase—Selects or displays the status of the reference clock phase. Valid choices are Normal and Inverted.
H	DTE Handshake—Selects the control lead mode. If manual mode is selected, each control lead must be forced ON or else it will be forced OFF. If manual mode is selected DSR must be forced on or no user data will be sent. In Automatic DTE handshake mode each lead will be asserted in accordance with the state of the complimentary lead. In automatic mode DSR is output high and user data is sent only if the DTE asserts DTR.
—	DTE Type—Indicates which type of rear connector module (CIM) has been detected. This field might display HSSI, V.35, EIA 530, EIA 530A, or RS-449. If this field says NONE then either the front and rear cards have not seated together properly or a hardware problem exists.
Q1	QUAD Card 1—The Q1 command is used to select which ports on the first QUAD 2164 card will be used to carry traffic for this IMUX 2160 module. If the IMUX 2160 is to use all of the ports on the first QUAD 2164 module type “Q1” and press ENTER. At the second prompt enter "1,2,3,4". In any QUAD/IMUX installation the first QUAD 2164 module must be installed in an odd-numbered slot in the shelf.
Q2	QUAD Card 2—The Q2 command is used to select which ports on an (optional) second QUAD 2164 card will be used to carry traffic for this IMUX 2160 module. If the IMUX is to use all of the ports on the second QUAD 2164 module type “Q2” and press ENTER. At the second prompt enter "1,2,3, 4". Whenever a second QUAD 2164 module is used in a QUAD/IMUX installation, it must be installed in an even-numbered slot.
1	DSR—In Manual mode, this field is used to FORCE Data Set Ready (DSR) on or to force DSR off. Since DSR must be YES for data to be sent, it is never desirable to select Manual for DTE handshake and fail to force DSR on. In Automatic DTE handshake mode this field indicates the current state of Data Set Ready (DTR). “Yes” indicates the lead is asserted or high, “No” indicates the lead is not asserted or low. If DSR is not asserted, no data is sent. If the DTE does not assert DTR, then the IMUX does not return DSR and no data is sent unless DTE Handshake is set to MANUAL and DSR is then forced ON by selecting "Yes".
2	CTS—In Manual DTE Handshake mode, this field is used to FORCE the Clear to Send signal on, or to force the CTS lead to be off at all times. In manual DTE Handshake mode, if this lead is not forced on, it is forced off. In Automatic DTE handshake mode this field becomes an indicator of the status of the CTS lead. Unless the IMUX is out of sync with the far end IMUX, CTS should follow Request To Send (RTS).
3	DCD—In Automatic DTE handshake mode this field becomes an indicator of the status of the Data Carrier Detect (DCD) lead. "Yes" means DCD is being asserted by the IMUX. "No" means the IMUX is currently outputting a low on DCD, turning it off. In Manual DTE Handshake mode, this field is used to FORCE the DCD lead on or force the DCD lead off. It is never advantageous to force DCD off at all times.
4	RI—Not Available with this product. RI stands for Ring Indicator. Ring Indicator is used on POTS (Plain Old Telephone Service) switched network modems to indicate that the telephone line is ringing because of an incoming telephone call.

Command/Field	Description
5	TM—TM stands for Test Mode, it is a lead defined in many synchronous serial interface protocols which the DCE (IMUX 2160) can use to indicate to the DTE that the DCE is in a test mode. In automatic DTE handshake mode TM is on during a test and off when there is no test. In manual DTE handshake mode TM is forced off at all times if this field says NO or forced on at all times if this field says YES.
Lines Equipped	This informational field indicates which ports the IMUX has been configured to use by way of the Q1 and Q2 commands. The ports of the first QUAD 2164 module are listed as one through four and the ports of any second quad 2164 module display under the numbers five through eight. An “X” indicates a selected port, a blank space indicates that port has not been selected.
Lines Active	Shows which lines are currently in use by the IMUX 2160 module. The IMUX 2160 module uses a line that has been *equipped* only if Frame Sync and Clear To Send signals are active.
Frame Status	Shows that the selected IMUX 2160 module has recognized and synchronized with the IMUX frame structure on the incoming RX signal on these lines.
CTS Status	Shows that the selected IMUX 2160 module has received via IMUX Frame signalling bits, confirmation of frame detection and synchronization by the far-end IMUX 2160 module on these lines.
CRC Status	Shows that a Cyclic Redundancy Check error was detected in one or more of a group of five IMUX frames on these lines.
Far CRC Status	Shows that a Cyclic Redundancy Check error was detected by the far-end IMUX, in one or more of a group of five IMUX frames on these lines.
X	Main Menu—Use this option to return to the Main Menu.

Chapter 4

T1 Configuration Menus

The menus included in this chapter apply to a standalone configuration. Similar menus are available from the Node Controller Module (NCM 2000), although options may display in a different order. For more information on the NCM 2000, see the *NCM 2000 User Manual*.

Node Management

There are three node management options for the QUAD 2164.

- ASCII Craft interface (by direct connection to the LOCAL port or via Telnet over an Ethernet TCP/IP LAN)
- Verilink Node Manager software (requires NCM 2000 controller module)
- SNMP (via 10BaseT port on QUAD 2164 or through NCM 2000)

This chapter documents the Craft interface. For more information on using Node Manager, see the *Node Manager User Guide*. For more information on NCM, see the *NCM 2000 User Manual*. For more information on using SNMP, see your SNMP documentation

Craft Interface

To access the Craft interface screen, use an ASCII terminal emulator connected to the QUAD 2164 Craft port. This section uses the QUAD 2164 and IMUX 2160 modules to show the Craft port ASCII screens. Set your terminal parameters to match the following values:

- 19,200 data rate
- 8 data bits
- No parity
- One stop bit
- No flow control

1. At the **pSH+>** prompt type “craft” and press ENTER.
2. At the **password** prompt press ENTER (default password).

The QUAD 2164 Main Menu appears (Figure 4-1).

Figure 4-1 QUAD 2164 Main Menu

```
-- VERILINK ACE CONTROLLER at [1,1]: FW Rev 4.30, Oct 12 1998  --

Site Name:
Access level:  4
                          <- SLOT ->
 SHELF   1   2   3   4   5   6   7   8   9   10  11  12  13
   0     -   -   -   -   -   -   -   -   -   -   -   -   -
   1 D  [*Q] M
   2     -   -   -   -   -   -   -   -   -   -   -   -   -
   3     -   -   -   -   -   -   -   -   -   -   -   -   -
   4     -   -   -   -   -   -   -   -   -   -   -   -   -
   5     -   -   -   -   -   -   -   -   -   -   -   -   -
   6     -   -   -   -   -   -   -   -   -   -   -   -   -
   7     -   -   -   -   -   -   -   -   -   -   -   -   -
   8     -   -   -   -   -   -   -   -   -   -   -   -   -
KEY: *=CONTROLLER N=NCM Q=QUAD M=IMUX A=DIDCSU U=DCSU P=DPRI

S) shelf/slot                 O) node administration
M) enable alarm monitor       A) display alarm buffer
C) configuration              D) diagnostics
P) performance/status         B) circuit
X) system log off

[1,1] QUAD 2164 >
```

Table 4-1 Main Menu Commands

Command	Description
S	Shelf/slot—See Shelf/Slot Selection in this chapter.
M	Enable Alarm Monitor—See Chapter 5, "*Performance Monitoring*".
C	Configuration—See T1 QUAD Configuration Menu in this chapter.
P	Performance/status—See Chapter 5, "*Performance Monitoring*".
O	Node Administration—See T1 Node Administration, in this chapter.
A	Display Alarm Buffer—See Chapter 5, "*Performance Monitoring*".
D	Diagnostics—See Chapter 6, "*Diagnostics*".
B	Circuit—Not supported by the QUAD/IMUX product.
X	System Log Off

Shelf/Slot Selection

To select a shelf and slot to manage, type “S” and press ENTER. Type the shelf number of the desired module and press ENTER. Type the slot number and press ENTER again. The screen updates to display the selected shelf and slot in **[ ]** brackets. In Figure 4-1 the QUAD 2164 module in shelf 1, slot 1 is the selected card.

T1 QUAD Configuration Menu

To configure the QUAD 2164 T1 options, select the QUAD shelf and slot, then type "C" and press ENTER. The QUAD 2164 Configuration Menu appears (Figure 4-2).

Figure 4-2 QUAD 2164 T1 Configuration Menu

```
--  QUAD 2164 CONFIGURATION MENU --


                              PORT 1     PORT 2     PORT 3     PORT 4

In)  In Service               YES        YES        YES        YES
Fn)  Frame Format             ESF        ESF        ESF        ESF
Ln)  Line Coding              B8ZS       B8ZS       B8ZS       B8ZS
Bn)  Line Build Out           0db        0db        0db        0db
NDn) Network Density          NONE       NONE       NONE       NONE
NLn) Network Initiated Loop   NO         NO         NO         NO
DLn) FDL Enable               NO         NO         NO         NO
     PRM Enable               NO         NO         NO         NO

F) FDL configuration          A) alarm configuration
C) copy port                  D) restore defaults
T) timing                     X) exit this screen

[1,1] QUAD 2164 >
```

Table 4-2 T1 Configuration Menu

Command	Description	Options
I*n*	In Service—Puts the selected port in service (Y) or takes it out of service (N). Ports must be placed in service before the IMUX 2160 module can use them.	Y or N
F*n*	Frame Format—Specifies the framing format as Extended Superframe (ESF) or Superframe (SF) for the selected port. Match the framing format provided by the network service provider (phone company).	1) SF 2) ESF
L*n*	Line Coding—Specifies the line coding for the selected port as Alternating Mark Inversion (AMI) or Binary 8-Zeros Substitution (B8ZS). You must match the line coding supplied by your network service provider.	1) AMI 2) B8ZS
B*n*	Line Build Out—Specifies the line build out for the selected port. If the T1 terminates in a network termination device (also called smart jack) then select a line build out value of 0dB. Always use 0db for a T1 installed in the USA by a local Bell carrier, unless otherwise directed by the carrier.	1) 0db 2) -7.5db 3) -15db 4) -22.5db
ND*n*	Network Density—Sets the type of ones density support for the selected port. Required only with AMI line coding. Select NONE for a B8ZS T1. Never select NONE for an AMI T1.	1) NONE 2) 80 zeros 3) 15 zeros 4) 12.5% 80s 5) TR 62411
NL*n*	Network Initiated Loop—Specifies if the port will respond to loopback requests received from the T1 network. Usually set to Yes.	Y or N

Command	Description	Options
DL*n*	FDL Enable—Enables or disables the facilities data link. Valid for ESF framing only. If you enable FDL for any ports, use option F to configure the port for FDL. PRM Enable—Displays whether Performance Report Messages are enabled in the FDL Configuration submenu.	**Y** or **N**
F	FDL Configuration—Refer to FDL Options in this chapter.	
A	Alarm Configuration—Refer to T1 Alarm Options in this chapter.	
C	Copy Port—After configuring one QUAD 2164 port, the settings can be copied to some or all of the other T1 ports. Enter the port to copy (1-4): 1 Enter the destination port (1-4 or 'A' for all): a Are you sure to copy port 1 to all ports? (y/n) y Copying port 1 to port 2 Copying port 1 to port 3 Copying port 1 to port 4	
D	Restore Defaults—Restores the QUAD 2164 to factory defaults. See Appendix A, "*Default Configuration*".	
T	Timing—Refer to T1 Alarm Options in this chapter.	
X	Return to the Main Menu.	

FDL Options

To configure the Facility Data Link (FDL) options from the QUAD 2164 Configuration Menu, type "F" and press ENTER. The QUAD 2164 FDL Options menu appears (Figure 4-3).

Figure 4-3 FDL Options Screen

```
--  QUAD 2164 CONFIGURATION MENU (FDL OPTIONS)--


                              PORT 1     PORT 2     PORT 3     PORT 4

Sn)  FDL Standard             T1.403     T1.403     T1.403     T1.403
Mn)  FDL Mode                 TERM       TERM       TERM       TERM
Pn)  Poll Mode                NO POLL    NO POLL    NO POLL    NO POLL
Cn)  PRM C/R bit              NONE       NONE       NONE       NONE
In)  Idle Pattern             FLAGS      FLAGS      FLAGS      FLAGS
An)  Send/Rec LLB BOP         YES        YES        YES        YES
Bn)  Send/Rec PLB BOP         YES        YES        YES        YES

X) exit this screen

[1,1] QUAD 2164 >
```

Table 4-3 T1 FDL Options Menu

Field Name	Description
FDL Standard	Specify if you want to use the ATT 54016 standard (TR54016), the ANSI T1.403 standard (T1.403), or both. Make the selection required by your carrier, if any.
FDL Mode	Specify terminated (TERM). (PASS) does not apply to the QUAD/IMUX.
Poll Mode	Specify if you want FDL to poll (POLL), not poll (NO POLL), or accept unsolicited information (UNSOLICIT). • POLL: The near-end CSU automatically polls the far-end CSU for alarms every 4 seconds and reports these alarms. Functions only if the FDL portion of the ESF framing is routed through any DACS in the T1 network. • NO POLL: Disables alarm polling at both ends. Select this option when the nodes at both ends are connected and both nodes report local alarms. • UNSOLICIT: The QUAD 2164 automatically sends its alarm status (when it detects an LOS) to the far-end.
PRM C/R bit	The Performance Report Message Command/Response as defined in the ANSI T1.403 specification. Specify USER to set the bit to 0, indicating the PRM source terminal. Specify TELCO to set the bit to 1, indicating the Telco is the PRM source. Phone companies usually set to TELCO, non phone companies set to USER. If you do not wish to set it to either USER or TELCO, choose NONE.
Idle Pattern	Selects the idle pattern code for the 4K FDL portion of the ESF framing. The Idle Pattern is sent when there is no other FDL traffic. Depending on your network, select either ALL ONES or FLAGS. The selected signal is transmitted continuously until a message is sent. Upon message completion, it reverts to the signal of choice: • ALL ONES is a signal on an FDL comprised entirely of ones: 11111111. • FLAGS is a signal on an T1 FDL line comprised of 01111110.
Send/Rec LLB BOP	Enable Line Loopback Bit-Oriented Protocol (LLB BOP) if you want to use FDL loopbacks to test the T1 line.
Send/Rec PLB BOP	Enable Payload Loopback Bit-Oriented Protocol (PLB BOP) if you want to use FDL loopbacks to test the CSU from the far-end circuit.
Exit this screen	Use this option to return to the Main Menu.

T1 Alarm Options

To configure the QUAD 2164 alarm options, type “A” and press ENTER from the QUAD 2164 Configuration Menu. The QUAD 2164 Alarm Options Menu appears (Figure 4-4).

Figure 4-4 T1 Alarm Options Menu

```
--  QUAD 2164 CONFIGURATION MENU (ALARM OPTIONS)--

N) NMS Address:          128.0.0.0
D) Alarm declare time:   1
A) Card Alarm Reporting: YES

                              PORT 1     PORT 2     PORT 3     PORT 4

Pn)  Alarm Reporting          YES        YES        YES        YES
Ln)  Line Restoral            AUTO       AUTO       AUTO       AUTO
Cn)  CRC Threshold            0          0          0          0
Sn)  SES Threshold            0          0          0          0
Un)  UAS Threshold            0          0          0          0
Bn)  BER Threshold            DISABLE    DISABLE    DISABLE    DISABLE
Tn)  TOD HH:MM                00:00      00:00      00:00      00:00
In)  Clear Interval           30         30         30         30

 X)  exit this screen

[1,1] QUAD 2164 >
```

Table 4-4 T1 Alarm Options Menu

Field Name	Description
N	NMS Address—Selects or displays the Verilink ACP address for Node Manager (the address of the PC that will receive the alarms). This is not any kind of TCP/IP address, although it has the same four-octet structure. The first octet of this field must never be lower than 128.
D	Alarm Declare Time—Selects or displays how many seconds will elapse before a error message is activated.
A	Card Alarm Reporting—Use this option to enable or disable alarms reported from the card to the alarm buffer and screen display. This option must be enabled to allow normal operation of the critical line restoral feature.
P*n*	Port Alarm Reporting—Use this option to enable or disable alarms reported from each port to the alarm buffer and screen display. This option must be enabled for each port being used by the associated IMUX 2160 module to allow normal operation of the critical line restoral feature.
L*n*	Line Restore—Use this option to determine under what circumstances a T1 port previously removed from service will be restored after the failure clears. This option is critical to normal QUAD/IMUX operation. See the section Line Restoral Options in this chapter.
C*n*	CRC Threshold—Use this option to specify the maximum number of CRC errors that can occur during a 15-minute integration period before the line is removed from service.
S*n*	SES Threshold—Use this option to specify the maximum number of Severely Errored Seconds errors that can occur before the line is removed from service.
U*n*	UAS Threshold—Use this option to specify the maximum number of Unavailable Seconds errors that can occur before the line is removed from service.

Field Name	Description
B*n*	BER Threshold—Use this option to specify the maximum number of Bit Error Rate errors that can occur before the line is removed from service.
T*n*	TOD HH:MM—Use this option to set the time of day in hours and minutes when a line removed from service should be restored (if the Clear Interval time is met).
I*n*	Clear Interval—Use this option to specify how long a line removed from service must be error-free before attempting restoral. See Line Restoral Options below for more information. Verilink recommends that you set the Clear Interval parameter to 30 seconds.
X	Exit—Use this option to return to the Configuration Menu.

Line Restoral Options

The IMUX 2160 will immediately stop using any of the assigned T1 ports when a major circuit failure occurs. The three alarm conditions which trigger this immediate and unconditional reaction are

- Loss Of Signal (LOS)
- Loss Of Frame (LOF)
- An unframed all ones pattern on the receive pair (Alarm Indication Signal—AIS).

Additionally, the IMUX 2160 will stop using a particular T1 for lesser alarm conditions if so configured on the Alarm Options Menu (Figure 4-4). This conditional action is based on the values set for CRC, SES, UAS and BER. The default values for these types of errors will not trigger a line removal.

Once removed, a line remains out of service *Permanently* unless the line restoral option has been changed from its default value (Off) .

Option Values

- Off—A failed and now recovered T1 will not be placed back into service until a different value is chosen. This option has exactly the same effect as Manual. It is unlikely to be the desired selection, although it is the default.
- Manual—A failed and now recovered T1 will not be placed back into service until a different value is chosen. This option has exactly the same effect as Off. It is unlikely to be the desired selection.
- Automatic—Restores a failed and now recovered T1 to service as soon as it has been error-free for the number of seconds specified in the Clear Interval field. This selection is most likely to give desired operation.
- TOD—Specifies a time of day that a line removed from service will be restored if it has met the Clear Interval requirement for error free operation. This selection might be used when certain times of day are less critical than others. Enter the time in a 24-hour format.

T1 Timing Options

To configure the QUAD 2164 timing options, type "T" at the Configuration Menu and press ENTER. The QUAD 2164 Timing Options menu appears (Figure 4-5).

NOTE: *The Receive clock from shelf option must be set to Yes for all QUAD/IMUX applications.*

Figure 4-5 T1 Timing Options Screen

```
--  QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current shelf timing source: Card 1, INT

Source       Slot Number   Synchronization   Auto Restore

PRIMARY       PC) 1        PS) INT          PA) YES

SECONDARY     SC) 1        SS) INT          SA) YES

TERTIARY      TC) 1        TS) INT          TA) YES

R) Receive clock from shelf:  YES
X) exit this screen
```

Table 4-5 T1 Timing Options Menu

Field Name	Description
PC (Primary) SC (Secondary) TC (Tertiary)	Source—If the QUAD 2164 module derives its timing from a circuit element, enter the slot of the circuit element which will be the timing source. (This includes the option of setting your QUAD as the timing source for the shelf.) Select a primary timing source "PC" and also the secondary "SC" and tertiary timing sources "TC". The latter two sources provide a backup in case the primary source fails.
PS	Primary Synchronization—Choose one of the following as your primary source for time synchronization. • NET 1: Use this option to synchronize timing to T1 port 1. • NET 2: Use this option to synchronize timing to T1 port 2. • NET 3: Use this option to synchronize timing to T1 port 3. • NET 4: Use this option to synchronize timing to T1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source.

Field Name	Description
SS	Secondary Synchronization—Use this option to specify an alternate source of timing for synchronization purposes. In the event that the primary source is unavailable, this source will be used. • NET 1: Use this option to synchronize timing to T1 port 1. • NET 2: Use this option to synchronize timing to T1 port 2. • NET 3: Use this option to synchronize timing to T1 port 3. • NET 4: Use this option to synchronize timing to T1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source.
TS	Tertiary Synchronization—Use this option to specify an alternate source of timing for synchronization purposes. In the event that the primary and secondary source are unavailable, this source will be used. • NET 1: Use this option to synchronize timing to T1 port 1. • NET 2: Use this option to synchronize timing to T1 port 2. • NET 3: Use this option to synchronize timing to T1 port 3. • NET 4: Use this option to synchronize timing to T1 port 4. • INTERNAL: Selects the internal clock as your timing source. • EXTERNAL: Selects an external clock as your timing source.
PA (Primary) SA (Secondary) TA (Tertiary)	Auto Restore—Selects which timing source will be used when the primary timing source fails, restores, and then remains viable for a period of 60 seconds. For example, if the primary source fails, the secondary source becomes the timing source. When the primary source is back in service, and the Auto Restore option is set to Yes, the primary source resumes as the QUAD 2164 module's timing source. If the Auto Restore option is set to No, the secondary source remains the timing source until you manually set the primary source's Auto Restore option to Yes.
R	Receive clock from shelf—Indicates whether the QUAD will receive its timing signal from the source used by the shelf or derive timing independently of all other modules. For QUAD/IMUX applications, this option *must* be set to Yes.
X	Exit this menu

Restore Defaults

Restores the factory default settings. See Appendix A, "*Default Configuration*" for the default values.

T1 Node Administration

The QUAD 2164 Administration Menu is used to set the TCP/IP and Verilink proprietary address parameters, to restart the module, and to perform firmware upgrades.

Beneath the title, the site name and access level of the current user are displayed. The site name is entered in the Node Administration Menu. The access level is determined by the password, with Level 4 at the highest level.

NOTE: *The four levels of passwords are a function of the NCM 2000. The QUAD/IMUX has a one level password. The default password is pressing the* ENTER *key.*

To specify node administration parameters for the selected QUAD 2164 module, type "O" from the QUAD 2164 Main Menu.

Figure 4-6 QUAD 2164 Administration Menu

```
--  ACE CONTROLLER ADMINISTRATION MENU --

Date/Time/Zone:     3-21-98  17:23:50
Node Address:       [123.0.2.6]
Ethernet Type       Ethernet 2
IP Address:         [192.94.45.242]
Sub-net mask:       [255.255.255.0]
Slip Address:       [0.0.0.0]
Slip sub-net mask:  [255.255.255.0]
Trap Addresses:     [0.0.0.0] [0.0.0.0]
                    [0.0.0.0] [0.0.0.0]
Gateway Address:    [0.0.0.0]
Read Community string:
Write Community string:

System uptime:      18:18:48
ACP bus:            C
T) set time                   D) set date
Z) set time zone              A) set node address
N) network parameters         M) modem parameters
R) reset card                 P) change password
Q) query firmware             Y) switch over once
O) switch over permanent      W) write file to flash
I) change site name           B) change ACP bus
C) clear card configuration   X) main menu
```

CAUTION Never configure any SLIP IP address or SLIP Subnet mask in any QUAD 2164 module. The product does not support SLIP. No physical interface on the module can be used for SLIP. Certain errors which might be made while configuring SLIP parameters will render the module inoperative and require factory repair. The SLIP commands have been removed in version 4.31 QUAD 2164 firmware.

Figure 4-7 QUAD 2164 Administration Menu, Network Parameters

```
--  ACE CONTROLLER ADMINISTRATION MENU --

Date/Time/Zone:     06-22-99  16:31:41
Node Address:       [not set]
Ethernet Type       Ethernet 2
IP Address:         [0.0.0.0]
Sub-net mask:       [0.0.0.0]
Slip Address:       [0.0.0.0]
Slip sub-net mask:  [0.0.0.0]
Trap Addresses:     [0.0.0.0] [0.0.0.0]
                    [0.0.0.0] [0.0.0.0]
Gateway Address:    [0.0.0.0]
Read Community string:
Write Community string:

System uptime:      30:07:33
ACP bus:            C
T) set time                   D) set date
Z) set time zone              A) set node address
N) network parameters         M) modem parameters
R) reset card                 P) change password
Q) query firmware             Y) switch over once
O) switch over permanent      W) write file to flash
I) change site name           B) change ACP bus
C) clear card configuration   X) main menu

[1,1] QUAD 2164 >
```

Table 4-6 T1QUAD 2164 Administration Menu

Command/Field	Description
D) Set Date T) Set Time Z) Set Zone	Date/Time/Zone—This field displays the QUAD 2164 module's current date and time. To change the time zone, type "Z". At the Select Timezone prompt, select, local time, Eastern Standard Time (EST), Central Standard Time (CST), Mountain Standard Time (MST), and Pacific Standard Time (PST). To create your own time zone specification, or to specify a time zone not shown, select custom and enter the necessary information. To change the date, type "D". Enter the new date as the number of the month (01-12), number of the day of the month (01-31), and the last two digits of the current year (e.g., 99). To change the time, type "T". Enter the new time as the number of hours (00-24), number of minutes (00-60), and number of seconds (00-60). ***Note:*** *Set the time zone before setting the time.*
A	Node Address—This field displays the QUAD's node ACP address. To change this address, type "A" and enter a new four-byte address.
1) Ethernet 2 (DIX) 2) 802.3	This field displays the Ethernet framing type configured for the card. To change this specification, type "N" (network parameters), then "T" (Ethernet type). If your network uses TCP/IP, select **1) Ethernet 2 (DIX)**. See Figure 4-7.
IP Address	This field displays the Ethernet IP address for the card. To change this address, type "N" (network parameters), then "I" (Ethernet IP address). See Figure 4-7.
Sub-net Mask	This field displays the Ethernet sub-net mask for the card. To change this value, type "N" (network parameters), then "M" (Ethernet subnet mask). See Figure 4-7.
Slip Address	Do not configure SLIP on the QUAD 2164. There is no physical interface on the QUAD 2164 which supports SLIP. *Errors made while configuring SLIP may lockup the module, requiring factory repair*. This field was removed in version 4.31 QUAD 2164 firmware.
Slip Sub-net Mask	Do not configure SLIP on the QUAD 2164. There is no physical interface on the QUAD 2164 which supports SLIP. *Errors made while configuring SLIP may lockup the module, requiring factory repair*. This field was removed in version 4.31 QUAD 2164 firmware.
Trap Addresses	This field displays the SNMP trap IP addresses. To change this address, type "N" (network parameters), then "P*n*" (trap addresses), where *n* is the number of the address to be changed. See Figure 4-7.
Gateway Address	This field displays the IP address of the node's gateway. This is a device, typically a router, which the QUAD 2164 is to use when communicating with a TCP/IP address on a different physical LAN segment. To change this address, type "N" (network parameters), then "G" (gateway ip address). See Figure 4-7.
Read Community String	This field displays the SNMP community read string. To change this rudimentary password, type "N" (network parameters), then "R" (SNMP read community string). See Figure 4-7.
Write Community String	This field displays the SNMP community write string. To change this rudimentary password, type "N" (network parameters), then "W" (SNMP write community string). See Figure 4-7.
System Uptime	This field displays the amount of time (in hours, minutes, and seconds) that the node has been operating. It resets to zero every time the node is rebooted.
N	Network Parameters—Selects a submenu used to change TCP/IP parameters such as Ethernet IP address, Subnet Mask, Gateway, and Trap Host addresses.

Command/Field	Description
M	Modem Parameters—Not supported by this product.
R	Reset Card—Restarts the QUAD 2164 without loading firmware from either flash partition. Similar to a warm boot on a PC. Do not use reset card to test firmware upgrades, the newly installed firmware will not be loaded. Press “Y” to confirm you wish to restart the module. Any Telnet session will be dropped, user data will be disrupted.
P	Change Password—Sets privileged and unprivileged passwords. At the Password Menu, type “P” to set privileged passwords. Type “U” to set unprivileged passwords. Privileged users have network administrator permissions and can change all parameters. Unprivileged users have run time access to QUAD 2164 module capabilities, but cannot make changes to parameters.
Q	Query Firmware—Verifies the status of the firmware and memory in the active partition (A or B). When you type “Q’, the screen reports the version level and status of the partition firmware and RAM.
Y	Switch Over Once—Switches the active firmware partition (used typically to test new firmware). At the prompt, select the partition (A or B) to switch to temporarily. When you reboot the card, the original partition will be used. Any Telnet session will be dropped, user data will be disrupted.
O	Switch Over Permanent—Permanently switches the active firmware partition. At the prompt, select the partition (A or B) to switch to permanently. When you reboot the card, this new partition is used as the boot partition. Any Telnet session will be dropped, user data will be disrupted.
W	Write File to Flash—Updates the flash image in the nonactive partition. Requires overwrite confirmation of the nonactive partition.
B	Change ACP Bus—Changes the ACP communications bus used to communicate with an NCM 2000 or other modules in the shelf. You must reset the card to make the change effective. In most cases, Bus C should be selected for QUAD/IMUX applications.
X	Main Menu—Return to the Main Menu.

IMUX Configuration

This section discusses the T1 IMUX 2160 module configuration.

T1 IMUX Configuration Menu

To display the Configuration Menu, select an IMUX 2160 module from the Main Menu and type "C" for configuration. The T1 IMUX Configuration Menu appears (Figure 4-8).

Figure 4-8 T1 IMUX Configuration Screen

```
--  IMUX 2160 CONFIGURATION MENU --

L) Line Type   :   T1               1) DSR NO
C) Channel Rate:   64K              2) CTS NO
R) Rx Clk Phase:   INVERT           3) DCD YES
T) Tx Clk Phase:   INVERT           4) RI YES
F) Ref Clk Phase:  NORMAL           5) TM NO
H) DTE Handshake:  AUTOMATIC
   DTE Type:       V.35
Q1) Quad Card 1:   1 2 3 4
Q2) Quad Card 2:

                    1  2  3  4  5  6  7  8
Lines Equipped:     X  X  X  X
Lines Active:       X  X  X  X
Frame Status:       X  X  X  X
CTS Status:         X  X  X  X
CRC Status:
Far CRC Status:

X) main menu

[1,2] IMUX 2160 >
```

NOTE: *Careful consideration must be given to the selection for DTE handshake. If MANUAL is selected every control lead is immediately forced off. The required control leads must then be forced on. In MANUAL DTE Handshake mode DSR must be forced on or no data will be transmitted. In AUTOMATIC mode the DTE must assert DTR or DSR will not be returned and no data will be transmitted.*

Table 4-7 T1 IMUX Configuration Menu

Command	Description
L	Line Type—Selects or displays the line configuration. Valid choices are T1 or E1.
C	Channel Rate—Selects or displays the data rate per DS0. Valid choices are 64K and 56K. If using an AMI T1 facility, 56K is required. For a B8ZS T1 or any E1, 64K can be used.

Command	Description
R	Rx Clk Phase—Selects or displays the status of the receive clock phase. Valid choices are Normal and Inverted.
T	Tx Clk Phase—Selects or displays the status of the transmit clock phase. Valid choices are Normal and Inverted.
F	Ref Clk Phase—Selects or displays the status of the reference clock phase. Valid choices are Normal and Inverted.
H	DTE Handshake—Selects the control lead mode. If manual mode is selected, each control lead must be forced ON or else it will be forced OFF. If manual mode is selected DSR must be forced on or no user data will be sent (never send data option). In Automatic DTE handshake mode each lead will be asserted in accordance with the state of the complimentary lead. In automatic mode DSR is output high and user data is sent only if the DTE asserts DTR.
–	DTE Type—Indicates which type of rear connector module (CIM) has been detected. This field might display HSSI, V.35, EIA 530, EIA 530A, or RS-449. If this field says NONE then either the front and rear cards have not seated together properly or a hardware problem exists.
Q1	QUAD Card 1—The Q1 command is used to select which ports on the first QUAD 2164 card will be used to carry traffic for this IMUX 2160 module. If the IMUX is to use all of the ports on the first QUAD 2164 module type “Q1” and press ENTER. At the second prompt enter "1,2,3,4". In any QUAD/IMUX installation the first QUAD 2164 module must be installed in an odd-numbered slot in the shelf.
Q2	QUAD Card 2—The Q2 command is used to select which ports on an (optional) second QUAD 2164 card will be used to carry traffic for this IMUX 2160 module. If the IMUX is to use all of the ports on the second QUAD 2164 module type “Q2” and press ENTER. At the second prompt enter "1,2,3,4". Whenever a second QUAD 2164 module is used in a QUAD/IMUX installation, the card must be installed in an even-numbered slot
1	DSR—In Manual mode, this field is used to FORCE Data Set Ready (DSR) on or to force DSR off. Since DSR must be YES for data to be sent, it is never desirable to select Manual for DTE handshake and fail to force DSR on. In Automatic DTE handshake mode this field indicates the current state of Data Set Ready (DTR). Yes indicates the lead is asserted or high, No indicates the lead is not asserted or low. If DSR is not asserted, no data is sent. If the DTE does not assert DTR, then the IMUX does not return DSR and no data is sent unless DTE Handshake is set to MANUAL and DSR is then forced ON by selecting YES.
2	CTS—In Manual DTE Handshake mode, this field is used to FORCE the Clear to Send signal on, or to force the CTS lead to be off at all times. In manual DTE Handshake mode, if this lead is not forced on, it is forced off. In Automatic DTE handshake mode this field becomes an indicator of the status of the CTS lead. Unless the IMUX is out of sync with the far end IMUX, CTS should follow Request To Send (RTS) when in Automatic DTE Handshake mode.
3	DCD—In Automatic DTE handshake mode this field becomes an indicator of the status of the Data Carrier Detect (DCD) lead. Yes means DCD is being asserted by the IMUX. No means the IMUX is currently outputting a low on DCD, turning it off. In Manual DTE Handshake mode, this field is used to FORCE the DCD lead on or force the DCD lead off. It is never advantageous to force DCD off at all times.
4	RI—RI stands for Ring Indicator. Ring Indicator is used on POTS (Plain Old Telephone Service) switched network modems to indicate that the telephone line is ringing because of an incoming telephone call. This option has no effect on anything.

Command	Description
5	TM—TM stands for Test Mode, it is a lead defined in many synchronous serial interface protocols which the DCE (IMUX 2160) can use to indicate to the DTE that the DCE is in a test mode. In automatic DTE handshake mode TM is on during a test and off when there is no test. In manual DTE handshake mode TM is forced off at all times, even during a test, if this field says NO or forced on at all times, even when there is no test, if this field says YES.
Lines Equipped	This informational field indicates which ports the IMUX has been configured to use by way of the Q1 and Q2 commands. The ports of the first QUAD 2164 module are listed as one through four and the ports of any second QUAD 2164 module display under the numbers five through eight. An **X** indicates a selected port, a blank space indicates that port has not been selected.
Lines Active	Shows which lines are currently in use by the IMUX 2160 module. An **X** is displayed if the IMUX 2160 module uses a line an *equipped* port has active Frame Sync and Clear To Send signals.
Frame Status	Shows that the selected IMUX 2160 module has recognized and synchronized with the IMUX frame structure on the incoming (RX) signal on these lines.
CTS Status	Shows that the selected IMUX 2160 module has received (via IMUX Frame signalling bits) confirmation of frame detection and synchronization by the far-end IMUX 2160 module on these lines.
CRC Status	Shows that a Cyclic Redundancy Check error was detected in one or more of a group of five IMUX frames on these lines.
Far CRC Status	Shows that a Cyclic Redundancy Check error was detected by the far-end IMUX, in one or more of a group of five IMUX frames on these lines.
X	Main Menu—Use this option to return to the Main Menu.

Chapter 5

Performance Monitoring

This chapter provides information about the QUAD/IMUX performance and status menus, including the following:

- LED states
- Alarm Menu
- Performance Monitoring Menu.

LED States

The QUAD/IMUX uses tri-color LEDs

QUAD 2164 LEDs

The SYS LED will blink green to off if the QUAD 2164 is the shelf controller for the management bus it is using (this could be Bus A or C). The SYS LED will be lit steady green if the shelf is controlled by another module (another QUAD 2164 or an NCM 2000).

NOTE: *If more than one module in a shelf displays a SYS LED blinking green-to-off, those modules are using different ACP bus segments. See the Node Administration Menu (in Chapter 3 for E1 versions or Chapter 4 for T1 versions).*

Red NET LED

The T1 port has been put into service, but the signal received at that port is different from the port's configuration. Ensure that the port's options have been configured correctly.

If the problem persists, select the Performance/Status options from the Main Menu and check for indications of a bad T1 signal:

- Loss of Signal (LOS)
- Loss of Frame (LOF)
- CRC errors.

Remove the T1 line from the port and install a loopback plug. If the LED turns green, call the network service provider.

Amber NET LED

A loopback has been activated on that port. Deactivate the loopback at the port from the Diagnostics Menu.

IMUX 2160 LEDs

The IMUX 2160 front panel has three tri-state LEDs labeled.

- DATA
- STAT
- NET

Red NET LED

If one of the T1 lines on the QUAD 2164 has a problem, the NET LED for that port is red.

Red STAT LED

If there is any error condition on the IMUX, the STAT LED shows red. One or both of the other LEDs are probably red if the STAT LED is red. Correct the error condition(s) suggested by the other red LED(s).

Amber DATA LED

The IMUX has an active data port Loopback. Deactivate the loopback using the Diagnostics Menu.

QUAD 2164 Performance Monitoring

To view performance and status information for the QUAD 2164, type "P" from the main screen and press ENTER. The Performance/Status Menu for T1 versions of the QUAD 2164 appears in Figure 5-1, the E1 versions in Figure 5-2.

Figure 5-1 QUAD 2164 Performance/Status Menu, T1 version

```
--  QUAD 2164 PERFORMANCE/STATUS MENU --

                    PORT 1     PORT 2     PORT 3     PORT 4

LOS                 YES        YES        YES        YES
LOF                 NO         NO         NO         NO
AIS Rx/Tx           NO/NO      NO/NO      NO/NO      NO/NO
RAI Rx/Tx           NO/YES     NO/YES     NO/YES     NO/YES
SLIP                NO         NO         NO         NO
CRC6                NO         NO         NO         NO
BER EX              NO         NO         NO         NO
Restore State       OOS        OOS        OOS        OOS

En) Errored Seconds           Un) Unavailable Seconds
Bn) Bursty Seconds            Sn) Severely Errored Seconds
Ln) LOS Seconds               Fn) SEF Seconds
Dn) LOF Seconds               On) OOF Seconds
An) AIS Seconds               Cn) Controlled Slip Seconds
Mn) Loss of Frame Counts      Zn) AIS/SEF Seconds
Qn) Errored Seconds Type A    T) Threshold Status
Rn) Reset Registers           X) exit this screen

[1,1] QUAD 2164 >
```

NOTE: *Certain menu options display with a letter followed by a lowercase n. The n is a variable representing a port number. Type the number of the port instead of a lowercase n.*

Table 5-1 QUAD 2164 Performance/Status Menu, T1 Version

Field/Command	Description
LOS	Displays the number of Loss of Signal (LOS) Seconds: A second during which the QUAD 2164 module is in a Loss of Signal state. LOS is declared upon detecting 100 consecutive zeros, it is cleared with the receipt of the next 1 bit.
LOF	Displays the number of Loss of Frame (LOF) Seconds: An LOF alarm is declared when a 3-second interval of continuous Out of Frame (OOF) or Loss of Signal (LOS) state is detected. If at least 10 seconds elapse without an LOS or LOF error, the LOF alarm is cleared.

Field/Command	Description
AIS Rx/Tx	Displays the number of Alarm Indication Signal (AIS) Seconds (received and transmitted): A count of one-second intervals containing one or more AIS defects. AIS is an unframed ALL-ONEs bit pattern that indicates an alarm condition exists upstream in a circuit leading to the downstream equipment. This is also called an ALL-ONEs Keep-Alive or Blue Alarm Signal. An AIS defect is declared when there are three or fewer zeros in 512 bit times and there is an LOF defect. It is cleared when there are three or more zeros in two frames or the LOF defect no longer exists.
RAI Rx/Tx	Displays the number of Remote Alarm or Remote Alarm Indications (RAI) received and transmitted. It is the alarm a receiving CSU sends to the other end of the circuit when it detects a Loss of Signal or Loss of Frame. There is a 2- to 3-second integration period upon detection of LOS or LOF before an alarm is sent to the far-end equipment. This condition is also referred to as a Yellow Alarm.
SLIP	Indicates a timing slip error condition.
CRC6	Cyclic Redundancy Check is an error-checking algorithm performed on data transmissions. In simplified terms, for each extended superframe, a numerical value is derived from the data in the bit stream at the transmit end. When each extended superframe reaches the receive end, the cyclic redundancy check is calculated again and compared with the value generated by the transmit-side data. Discrepancies indicate one or more errors in the T1 facility.
BER EX	Indicates that the configured Bit Error Rate threshold has been exceeded. The BER threshold determines the level above which a CSU alarm is generated and reported. Selecting 10E-9 will report more errors than 10E-4.
Restore State	Shows the current condition of each port. OOS (Out Of Service) means that the port has been removed from service by the IMUX 2160. If a port is removed from service, it will not be placed back into service until the configured parameters for Line Restoral are met. See the Line Restoral section in Chapter 3 (E1) or Chapter 4 (T1).
E*n*	Errored Seconds—The number of seconds that a CRC-6 error is detected on the line.
U*n*	Unavailable Seconds—The number of seconds during which an Unavailable Signal State occurs. This occurs after ten consecutive SES and clears only after ten consecutive nonSES.
B*n*	Bursty Seconds—The number of one second intervals with between 2 and 319 CRC-6 error events. Bursty errored seconds are not counted when an SES or UAS is counted..
S*n*	Severely Errored Seconds—A second with 320 or more CRC-6 error events, or one or more OOF (Out Of Frame) events.
L*n*	LOS Seconds—The number of seconds during which there is a Loss Of Signal state.
F*n*	SEF Seconds—This error occurs when the frame alignment threshold of 10E-3 errors in a given second is exceeded.
D*n*	LOF Seconds—The number of seconds during which there is a Loss Of Frame state.
O*n*	OOF Seconds—The number of seconds during which there is an Out Of Frame state.
A*n*	AIS Seconds—The number of seconds during which a pattern of unframed all ones (Alarm Indication Signal) is received.
C*n*	Controlled Slip Seconds—The number of seconds during which recoverable timing slips occurred.
M*n*	Loss of Frame Counts—The number of times frame sync has been lost.
Z*n*	AIS/SEF Seconds—The total number of Severely Errored Seconds or AIS seconds
Q*n*	Errored Seconds Type A—The number of seconds with only one CRC-6 error.
A	Threshold Status—Displays the count, an indication if the threshold value has been exceeded (Y or N), and the interval for LOF, LOS, RAI, AIS, and BPV.
R*n*	Reset Registers—Use this option to zero out all the performance and status registers.
X	Exit this menu—Use this option to return to the Main Menu.

Figure 5-2 QUAD 2164 Performance/Status Menu, E1 version

```
--  QUAD 2164 PERFORMANCE/STATUS MENU --

                    PORT 1     PORT 2     PORT 3     PORT 4

LOS                 YES        YES        YES        YES
LOF                 NO         NO         NO         NO
AIS Rx/Tx           NO/NO      NO/NO      NO/NO      NO/NO
RAI Rx/Tx           NO/YES     NO/YES     NO/YES     NO/YES
SLIP                NO         NO         NO         NO
CRC4                NO         NO         NO         NO
BER EX              NO         NO         NO         NO
Restore State       OK         OK         OK         OK

En) Errored Seconds-Path      Dn) Errored Seconds-Line
Sn) Severely Errored Sec-Path Qn) Severely Errored Sec-Line
Un) Unavailable Seconds       Fn) Frame Alignment Error Seconds
Cn) Code Violations-Path      Vn) Code Violations-Line
Hn) Failure Events-Path       Gn) Failure Events-Line
Bn) Background Block Error    Rn) Reset Registers
 T) Line Threshold Status      A) Threshold Alert Status
 X) exit this screen

[1,1] QUAD 2164 >
```

Table 5-2 QUAD 2164 Performance/Status Menu

Field/Command	Description
LOS	Displays the number of Loss of Signal (LOS) Seconds: A second during which the QUAD 2164 module is in a Loss of Signal state. LOS is declared upon detecting 100 consecutive zeros, it is cleared with the receipt of the next 1 bit.
LOF	Displays the number of Loss of Frame (LOF) Seconds: An LOF alarm is declared when a 3-second interval of continuous Out of Frame (OOF) or Loss of Signal (LOS) state is detected. If least 10 seconds elapse without an LOS or LOF error, the LOF alarm is cleared.
AIS Rx/Tx	Displays the number of Alarm Indication Signal (AIS) Seconds (received and transmitted): A count of one-second intervals containing one or more AIS defects. AIS is an unframed ALL-ONEs bit pattern that indicates an alarm condition exists upstream in a circuit leading to the downstream equipment. This is also called an ALL-ONEs Keep-Alive or Blue Alarm Signal. An AIS defect is declared when there are three or fewer zeros in 512 bit times and there is an LOF defect. It is cleared when there are three or more zeros in two frames or the LOF defect no longer exists.
RAI Rx/Tx	Displays the number of Remote Alarm or Remote Alarm Indications (RAI) received and transmitted. It is the alarm a receiving channel bank or multiplexer sends to the other end of the circuit when it detects a Loss of Signal or Loss of Frame. There is a 2- to 3-second integration period upon detection of LOS or LOF before an alarm is sent to the far-end equipment. This condition is also referred to as a Yellow Alarm.
SLIP	Indicates a timing slip error condition.

Field/Command	Description
CRC4	This field will say "CRC6" for T1 versions and "CRC4" for E1 versions of the QUAD 2164. Cyclic Redundancy Check is an error-checking algorithm performed on data transmissions. In simplified terms, on a frame-by-frame basis, a numerical value is derived from the data in the bit stream at one end of transmission. When each frame reaches the receive end, the cyclic redundancy check is calculated again and compared with the value generated by the transmit-side data. Discrepancies usually indicate one or more transmission errors.
BER EX	Indicates that the configured Bit Error Rate threshold has been exceeded. The BER threshold determines the level above which a CSU alarm is generated and reported. Selecting 10E-9 will report more errors than 10E-4.
Restore State	Shows the current condition of each port. OOS (Out Of Service) means that the port has been removed from service by the IMUX 2160. If a port is removed from service, it will not be placed back into service until the configured parameters for Line Restoral are met. See the Line Restoral section in Chapter 3 (E1) or Chapter 4 (T1).
E*n*	Errored Seconds-Path—The number of seconds that a CRC-4 error occurs on the line.
D*n*	Errored Seconds-Line—The number of seconds with one or more code violation - lines.
S*n*	Severely Errored Seconds-Path—The number of one second intervals with 320 or more CRC-4 errors.
Q*n*	Severely Errored Sec-Line—The number of severely errored seconds with code violation - line errors.
U*n*	Unavailable Seconds—Every second in which an Unavailable Signal State occurs with the onset of 10 contiguous SES errors.
F*n*	Frame Alignment Error Seconds—This error occurs when the frame alignment threshold of 10E-3 errors in a given second is exceeded.
C*n*	Code Violations-Path—The number of CRC-6 (for ESF framing) errors that will be tolerated before the line is removed from service.
V*n*	Code Violations-Line—The number of BPV errors in any 15 minute time period that will be tolerated before the line is removed from service.
H*n*	Failure Events-Path—The frame errors on the path connection.
G*n*	Failure Events-Line—The frame errors on an individual line on a path.
B*n*	Background Block Error—An errored block (2000 bits per block) not occurring as part of an SES. This alarm condition is less serious than an SES.
R*n*	Reset Registers—Use this option to zero out all the performance and status registers.
T	Line Threshold Status—Displays the count and amount exceeding the threshold value for SES, UAS, and CRC.
A	Threshold Alert Status—Displays the count, an indication if the threshold value has been exceeded (Y or N), and the interval for LOF, LOS, RAI, AIS, and BPV.
X	Exit this menu—Use this option to return to the Main Menu.

A sample Errored Seconds report is shown in Figure 5-3. To see this display for Port 2, type “E2” from the Performance/Status Menu.

Figure 5-3 Sample 24 Hour ES-P Performance Data Screen

```
PORT 1  24 HOUR ES-P PERFORMANCE DATA at 3-22-98  11:15:19
Site Name:                          Shelf: 1  Slot: 1
Valid Intervals: 12              Seconds in current interval: 8
ES-P   in 24 hours: 0              ES-P  in current interval: 0
Previous Day Total: 0

 1: 0     17: -     33: -     49: -     65: -     81: -
 2: 0     18: -     34: -     50: -     66: -     82: -
 3: 0     19: -     35: -     51: -     67: -     83: -
 4: 0     20: -     36: -     52: -     68: -     84: -
 5: 0     21: -     37: -     53: -     69: -     85: -
 6: 0     22: -     38: -     54: -     70: -     86: -
 7: 0     23: -     39: -     55: -     71: -     87: -
 8: 0     24: -     40: -     56: -     72: -     88: -
 9: 0     25: -     41: -     57: -     73: -     89: -
10: 0     26: -     42: -     58: -     74: -     90: -
11: 0     27: -     43: -     59: -     75: -     91: -
12: 0     28: -     44: -     60: -     76: -     92: -
13: -     29: -     45: -     61: -     77: -     93: -
14: -     30: -     46: -     62: -     78: -     94: -
15: -     31: -     47: -     63: -     79: -     95: -
16: -     32: -     48: -     64: -     80: -     96: -
```

A sample of Threshold Status is shown in Figure 5-3. To see this display, type “T” from the QUAD 2164 Performance/Status Menu.

Figure 5-4 Threshold Status Display

```
-- Threshold Status Display --

                    PORT 1     PORT 2     PORT 3     PORT 4

SES Exceeded        NO         NO         NO         NO
SES Count           0          0          0          0
UAS Exceeded        NO         NO         NO         NO
UAS Count           161        161        161        161
CRC Exceeded        NO         NO         NO         NO
CRC Count           0          0          0          0
```

Table 5-3 Threshold Status Display

Field Name	Description
SES Exceeded	Indicates port counters have exceeded the threshold value specified for Severely Errored Seconds.
SES Count	The current counter for Severely Errored Seconds.
UAS Exceeded	Indicates port counters which have exceeded the threshold value you specified for Unavailable Seconds.
UAS Count	The current counter for Unavailable Seconds.
CRC Exceeded	Indicates port counters which have exceeded the threshold value you specified for Cyclic Redundancy Checks.
CRC Count	The current counter for Cyclic Redundancy Checks.
Exit this Screen	Use this option to return to the Main Menu.

T1 Alarm Monitor

To enable or disable the alarm monitor, type “M”at the QUAD 2164 Main Menu. If alarm monitoring is enabled (the default), the prompt appears:

Alarm monitoring disabled

If the alarm monitor is disabled, the prompt returns:

Alarm monitoring enabled

The menu selection toggles between disable alarm monitor and enable alarm monitor. When the alarm monitor is enabled, all alarms are written to the alarm buffer.

Alarm Buffer Display

To display the alarm buffer, type “A” from the Main Menu. The QUAD 2164 Alarm Buffer Menu appears as shown in Figure 5-5.

Figure 5-5 QUAD 2164 Alarm Buffer Display

```
[1,2] QUAD 2164 >a
QUAD 2164 [01,02] PLB Minor Alarm port 03 9-25-96 19:27:22
Press enter to continue
```

IMUX Performance Monitoring

To view performance and status information for the IMUX 2160, select the shelf and slot for the IMUX. From the Main Menu, type "P" and press ENTER. The Performance/Status Menu appears. Figure 5-6 illustrates the HSSI version, Figure 5-7 illustrates the V.35 version.

Figure 5-6 IMUX Performance/Status Menu, HSSI Interface

```
--  IMUX 2160 PERFORMANCE/STATUS MENU --

Data Port Type:      HSSI
DTR:                 NO
Loop type A:         NO
Loop type B:         NO
AIS Pattern:         DISABLE
Loopback:            NONE

                    1  2  3  4  5  6  7  8
Lines Equipped:     X  X  X  X  X  X  X  X
Lines Active:       X  X  X  X  X  X  X  X
Frame Status:       X  X  X  X  X  X  X  X
CTS Status:
CRC Status:
Far CRC Status:

X) main menu

[1,2] IMUX 2160 >
```

Figure 5-7 IMUX Performance/Status Menu, V.35 Interface

```
--  IMUX 2160 PERFORMANCE/STATUS MENU --

Data Port Type:      V.35
AIS Pattern:         DISABLE
Loopback:            NONE

                    1  2  3  4  5  6  7  8
Lines Equipped:     X  X  X  X
Lines Active:
Frame Status:
CTS Status:
CRC Status:
Far CRC Status:

X) main menu

[1,2] IMUX 2160 >
```

Table 5-4 IMUX Performance/Status Menu

Field Name	Description
Data Port Type	Displays the type of data port. Types are: HSSI, V.35, EIA 530, EIA 530A, and RS-449.
DTR	Displays the HSSI status of the Data Terminal Ready parameter. Only appears if the DTE interface is HSSI.
Loop type A	Reports the status of Interchange circuit 143 (Loop A). Only appears if the DTE interface is HSSI. According to the HSSI specification, and absence of A and B means no loopback is requested. The presence of A and the absence of B means a Local Line Loopback has been requested (Loop C). The absence of A and the presence of B means a Remote Line Loopback has been requested (Loop B). The presence of A and B means a Local Digital Loopback has been requested (Loop A). Verilink refers to a Loop A as an Equipment Loopback (IMUX ELB), and Loop B as a Local Loopback in the QUAD 2164 module applied to all active lines used by the IMUX 2160 modules.
Loop type B	Reports the status of Interchange circuit 144 (Loop B). Only appears if the DTE interface is HSSI.
AIS Pattern	Displays the status of the Alarm Indication Signal (AIS) pattern. Valid options are Disabled, ALL ONES, ALL ZEROS.
Loopback	Shows which loopback (if any) is active. Valid options are NONE, ELB, and PLB.
Lines Equipped	Shows the status of each of the lines configured for use by the selected IMUX 2160 module.
Lines Active	Shows which lines are in use by the selected IMUX 2160 module. The IMUX 2160 module will use a line that has been “equipped” only if Frame Sync and Clear To Send signals are active.
Frame Status	Shows that the selected IMUX 2160 module has recognized and synchronized with the IMUX frame structure on the incoming (RX) signal on these lines.
CTS Status	Shows that the selected IMUX 2160 module has received via IMUX Frame signalling bits, confirmation of frame detection and synchronization by the far-end IMUX 2160 module on these lines.
CRC Status	Shows that a Cyclic Redundancy Check error was detected in one or more of a group of five IMUX frames on these lines.
Far CRC Status	Shows that a Cyclic Redundancy Check error was detected by the far-end IMUX 2160 module in one or more of a group of five IMUX frames on these lines.
Main Menu	Use this option to return to the Main Menu.

Chapter 6

Diagnostics

This chapter contains information about the QUAD/IMUX Diagnostics. The Diagnostics Menu is designed to aid in troubleshooting the QUAD/IMUX module using:

- Status Reporting
- Alarm Indications
- Loopbacks
- Test Patterns

Diagnostics Menu

The QUAD/IMUX Diagnostics Menu supports the following options:

- Status reporting
- Alarm transmission
- Loopback configuration

QUAD 2164 Diagnostic Menu

To use QUAD 2164 diagnostics, type "D" and press ENTER at the Main Menu. The Diagnostics Menu is displayed (Figure 6-1).

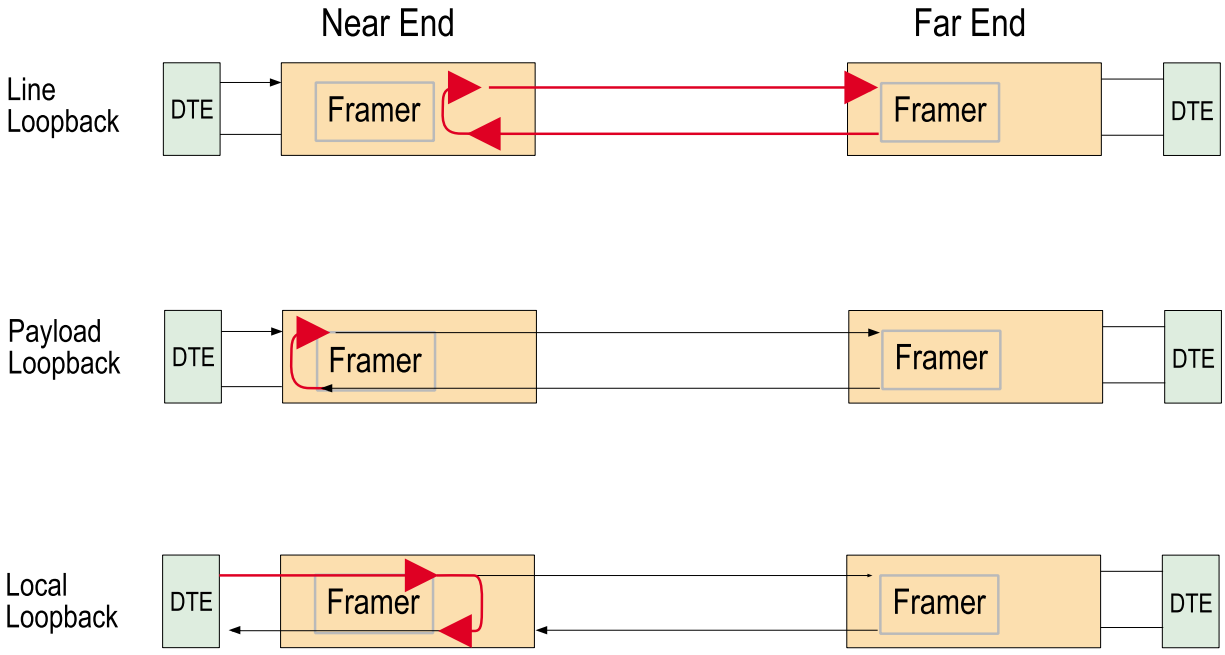
Figure 6-1 QUAD 2164 Diagnostic Menu

```
--  QUAD 2164 DIAGNOSTICS MENU --

                          PORT 1     PORT 2     PORT 3     PORT 4

Loop type                 NONE       NONE       NONE       NONE
Test Pattern              NONE       NONE       NONE       NONE
Test Error Counter        0          0          0          0

Ln) Line Loop                  Pn) Payload Loop
Rn) Local Loop                 Tn) Test Pattern
En) Reset Test Counter         X) exit this screen
```

Table 6-1 QUAD 2164 Diagnostic Menu

Command	Description
Loop Type	This field displays the type of loopback you have selected for each of the four QUAD ports. You can select Line (L), Payload (P), Local (R), and None.
Test Pattern	This field displays the type of test pattern you have selected using the T option.
Test Error Counter	This field displays the results of any loopbacks you are running.
L*n*	Line Loop—Use this option to activate or deactivate line loopbacks for the port(s) specified.
P*n*	Payload Loop—Use this option to activate or deactivate payload loopbacks for the port(s) specified.
R*n*	Local Loop—Use this option to activate or deactivate local loopbacks for the port(s) specified.
T*n*	Test Pattern—Use this option to select a test pattern. You can select None, 3/24, or QRSS.
Send LLB BOP	Use this option to send a request to activate or deactivate a line loopback to the far-end QUAD 2164 module. This loopback request is sent only in the FDL portion of the ESF framing on an ESF T1. It will not succeed unless the carrier routes the FDL to the far end.
Send PLB BOP	Use this option to send a request to activate or deactivate a payload loopback to the far-end QUAD 2164 module. This loopback request is sent only in the FDL portion of the ESF framing on an ESF T1. It will not succeed unless the carrier routes the FDL to the far end.
E*n*	Reset Test Counter—Use this option to clear the Test Error Counter field to zero for the port(s) specified.
Exit this Menu	Use this option to return to the Main Menu.

Figure 6-2 Loopbacks Illustrated



IMUX Diagnostics

The Diagnostics Menu for the IMUX 2160 is shown in Figure 6-3.

Figure 6-3 IMUX Diagnostic Menu

```
--  IMUX 2160 DIAGNOSTICS MENU --

Data Port Type:      HSSI
DTR:                 NO
Loop type A:         NO
Loop type B:         NO
AIS Pattern:         DISABLE
Loopback:            NONE

                    1  2  3  4  5  6  7  8
Lines Equipped:     X              X
Lines Active:
Frame Status:
CTS Status:
CRC Status:
Far CRC Status:

E) Equipment Loopback          P) Payload Loopback
A) AIS Pattern                 X) main menu
```

Table 6-2 IMUX Diagnostic Menu

Command	Description
Data Port Type	Displays the type of data port. Types are: HSSI, V.35, EIA 530, EIA 530A, and RS-449.
DTR	Displays the HSSI status of the Data Terminal Ready parameter. Only displays if the DTE interface is HSSI.
Loop Type A	Reports the status of Interchange circuit 143. Only displays if the DTE interface is HSSI. According to the HSSI specification, and absence of A and B means no loopback is requested. The presence of A and the absence of B means a Local Line Loopback has been requested (Loop C). The absence of A and the presence of B means a Remote Line Loopback has been requested (Loop B). The presence of A and B means a Local Digital Loopback has been requested (Loop A) Verilink refers to a Loop A as an Equipment Loopback (IMUX ELB), and Loop B as a Local Loopback in the QUAD 2164 module applied to all active lines used by the IMUX 2160 modules. Verilink does not support Loop C in this product.
Loop Type B	Reports the status of Interchange circuit 144. Only displayed if the DTE interface is HSSI.
AIS Pattern	Displays the status of the Alarm Indication Signal (AIS) pattern. Valid options are Disabled, ALL ONES, ALL ZEROS.
Test Pattern	Displays the status of the test pattern. Valid options are Disabled, 2 E23-1, and PN-127.
Loopback	Shows which loopback (if any) is active. Valid options are NONE, ELB, and PLB.
Lines Equipped	Shows the status of each of the lines configured for use by the selected IMUX 2160 module.
Lines Active	Shows which lines are in use by the selected IMUX 2160 module. The IMUX 2160 module will use a line that has been equipped only if Frame Sync and Clear To Send signals are active.

Command	Description
Frame Status	Shows that the selected IMUX 2160 module has recognized and synchronized with the IMUX frame structure on the incoming (RX) signal on these lines.
CTS Status	Shows that the selected IMUX 2160 module has received via IMUX Frame signalling bits, confirmation of frame detection and synchronization by the far-end IMUX 2160 module on these lines.
CRC Status	Shows that a Cyclic Redundancy Check error was detected in one or more of a group of five IMUX frames on these lines.
Far CRC Status	Shows that a Cyclic Redundancy Check error was detected by the far-end IMUX 2160 module in one or more of a group of five IMUX frames on these lines.
Equipment Loopback	Activates or deactivates ELB.
Payload Loopback	Activates or deactivates PLB.
AIS Pattern	Displays the status of the Alarm Indication Signal (AIS) pattern. Valid options are Disabled, ALL ONES, ALL ZEROS.
Main Menu	Use this option to return to the Main Menu.

Appendix

A

Default Configuration

This appendix contains the default values for the QUAD 2164 and IMUX 2160. The Configuration Menu for the QUAD 2164and IMUX 2160 contain default values. The remaining menus contain blank fields or disabled features such as loopbacks.

Configuration Menu Defaults

The Configuration Menu contains options with default settings. Figure A-1 and Figure A-2 show the default values for the QUAD 2164 and IMUX 2160 Configuration Menus.

Figure A-1 QUAD Configuration Menu Defaults

```
--  QUAD 2164 CONFIGURATION MENU --

                              PORT 1     PORT 2     PORT 3     PORT 4

In)  In Service               NO         NO         NO         NO
En)  CRC4                     NO         NO         NO         NO
Fn)  Carrier Failure Alarm    NO         NO         NO         NO
Sn)  FASE Alarm Category      MINOR      MINOR      MINOR      MINOR
Mn)  Framing Mode             CAS        CAS        CAS        CAS
Nn)  Alarm Declare Time(sec)  0          0          0          0
Pn)  Idle pattern             0000       0000       0000       0000
```

Table A-1 QUAD Configuration Menu Defaults

Command	Description
In	In service—No (all ports)
En	CRC4—No (all ports)
Fn	Carrier Failure Alarm—No (all ports)
Sn	FASE Alarm Category—Minor (all ports)
Mn	Framing Mode—CAS (all ports)
Nn	Alarm Declare Time —0 seconds (all ports)
Pn	Idle Pattern—0000 (all ports)
X	Exit this screen—Use this option to return to the main menu.

To access the threshold defaults for the QUAD 2164, select the QUAD Configuration Menu. Select menu option “T” to access the Group A Threshold Menu (Figure 2), or “U” to access Group B Threshold Menu (Figure 3).

Figure A-2 Configuration Menu - QUAD Net Port Alarm Group A Threshold Defaults

```
--  QUAD 2164 NET PORT ALARM THRESHOLD CONFIGURATION MENU --

                          PORT 1     PORT 2     PORT 3     PORT 4

Pn) Alarm Reporting       NO         NO         NO         NO
Fn) LOF threshold         3          3          3          3
    LOF interval          3          3          3          3
Ln) LOS threshold         3          3          3          3
    LOS interval          3          3          3          3
Rn) RAI threshold         1          1          1          1
    RAI interval          1          1          1          1
An) AIS threshold         1          1          1          1
    AIS interval          1          1          1          1
Bn) BPV threshold         1          1          1          1
    BPV interval          1          1          1          1

Tn) Set Default Thresholds       X) exit this screen
```

NOTE: *The QUAD/IMUX default values shown in Figures A-2 and A-3 are defaults established in Bellcore technical reference, OTGR 5.1, TR-TSY-000820.*

Figure A-3 Configuration Menu - QUAD Net Port Alarm, Group B Threshold Defaults

```
--  QUAD 2164 NET PORT ALARM THRESHOLD CONFIGURATION MENU --

                          PORT 1     PORT 2     PORT 3     PORT 4

Pn) Alarm Reporting       NO         NO         NO         NO
Cn) CV-P 15min threshold  16383      16383      16383      16383
    CV-P 24hr threshold   1048575    1048575    1048575    1048575
Vn) CV-L 15min threshold  16383      16383      16383      16383
    CV-L 24hr threshold   1048575    1048575    1048575    1048575
En) ES 15min threshold    900        900        900        900
    ES 24hr threshold     65535      65535      65535      65535
Dn) ES-L 15min threshold  900        900        900        900
    ES-L 24hr threshold   65535      65535      65535      65535
Sn) SES 15min threshold   900        900        900        900
    SES 24hr threshold    65535      65535      65535      65535
Qn) SES-L 15min threshold 900        900        900        900
    SES-L 24hr threshold  65535      65535      65535      65535
Un) UAS-P 15min threshold 900        900        900        900
    UAS-P 24hr threshold  65535      65535      65535      65535
In) BER threshold         DISABLE    DISABLE    DISABLE    DISABLE

Tn) Set Default Thresholds       X) exit this screen
```

Figure 4 shows the IMUX Configuration Menu defaults.

Figure A-4 IMUX Configuration Menu Defaults

```
--  IMUX 2160 CONFIGURATION MENU --

L) Line Type   :   E1               1) DSR NO
C) Channel Rate:   64K              2) CTS NO
R) Rx Clk Phase:   NORMAL           3) DCD YES
T) Tx Clk Phase:   INVERT           4) RI YES
F) Ref Clk Phase:  NORMAL           5) TM NO
H) DTE Handshake:  AUTOMATIC
   DTE Type:       HSSI
Q1) Quad Card 1:   1
Q2) Quad Card 2:   2

                    1  2  3  4  5  6  7  8
Lines Equipped:     X              X
Lines Active:
Frame Status:
CTS Status:
CRC Status:
Far CRC Status:
```

Figure A-5 shows the QUAD Configuration Menu, Timing Options Defaults.

Figure A-5 QUAD Configuration Menu, Timing Options Defaults

```
--  QUAD 2164 CONFIGURATION MENU (TIMING OPTIONS)--

Current shelf timing source: Card 1, INT

Source       Slot Number   Synchronization   Auto Restore

PRIMARY       PC) 1          PS) INT         PA) NO

SECONDARY     SC) 1          SS) INT         SA) NO

TERTIARY      TC) 1          TS) INT         TA) NO

R) Receive clock from shelf:  YES
X) exit this screen
```

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